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Chapter 1 - Introduction

This manual is written to Service Engineers, System Users, Equipment Owners, Hospital Administrators, and all other individuals responsible for the safe operation of x-ray equipment. All are responsible for carefully reading this manual, paying special attention to Warnings, Cautions, and Notes.

Audience

Equipment Owner

The Equipment Owner is responsible for ensuring that the x-ray system complies with the applicable sections of CFR 21, Subchapter J - Radiological Health. Compliance is periodically verified by subjecting the system to various test procedures defined by the Center for Disease and Radiological Health (CDRH). The owner is responsible for ensuring that only properly trained and qualified Service Engineers perform CDRH tests.

The Equipment Owner is responsible for ensuring that only persons who are trained and qualified are allowed to operate the x-ray system. When required, System Users must obtain credentials from local, state, and federal authorities. If the system fails to operate correctly, or fails to respond to system controls as outlined in this manual, notify the local, authorized Instrumentarium Imaging Ziehm, Inc. dealer representative.

Hospital Administration

Hospital administration is responsible for verifying that the equipment continues to operate within the correct calibration of mA, kV, time/mAs, and alignment of the useful beam.

Hospital administration is responsible for ensuring that the system complies with applicable local, federal, statutory, and regulatory requirements. Hospital administration is responsible for consulting with local, state, and federal agencies regarding requirements and regulations applicable to the system's use.

Instrumentarium Imaging Ziehm, Inc. assumes no responsibility or liability for after-sale operating and safety practices and is not responsible for personal injury or damage resulting from the misuse of its systems.

If you have any safety-related questions, contact your dealer representative.

Manufacturer

The manufacturer is responsible for the safety, reliability and efficiency of the equipment only when:

- installation, alterations or repairs are carried out by persons authorized by the manufacturer,
- the electrical installations in the room in which the ZIEHM is used correspond to the power requirements listed in Appendix A, and
- the equipment is used in accordance with this manual.

Responsibilities

Service Engineers

Service Engineers are responsible for installing, calibrating, and maintaining the C-Arm system. In order to be qualified to perform the procedures described in this manual, Service Engineers must attend formal training provided by Instrumentarium Imaging Ziehm, Inc. (hereafter referred to as the manufacturer).

System Users

System Users are responsible for reading and following each section of this manual that applies to them, which includes: Safety, System User Manual.

It does not contain any procedures that can be performed by the System Users. Do NOT allow System Users to perform any of the service tasks described in this manual, or any tasks that are not described in the User Manual.

CDRH Tests

This manual contains test procedures that the Center of Disease and Radiological Health (CDRH) requires to be performed as the system is installed, and prior to customer acceptance. A list of the equipment required to conduct these tests is included. Use only this equipment, or approved substitutes. If you have any questions concerning testing, call the manufacturer at: 909-781-2020, and ask for the Service department.

CDRH Report

This manual includes forms for recording required tests. Make several copies of these forms and safeguard the original. As tests are conducted, record the results onto a blank copy of the form. Keep the original, and send a copy to the manufacturer at the following address: 4181 Latham Street, Riverside, CA 92501.

Maintain original copies of completed forms for future reference.

Problems

If System Users have a equipment-related problem, they must immediately stop using the system and notify a Service Engineer. The system must not be operated until repairs have been made and the proper functioning of the system is verified.

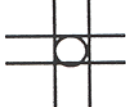
Service Engineers are responsible for:

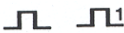
1. completing the records listed below,
2. filing the original, and for
3. forwarding copies to the indicated recipient.

Record	When Required	Recipient
Service log	Whenever any service is performed on the system	Original to Service files.
FDA Form 2579, Report of assembly diagnosis x-ray system	Whenever the system is installed, or when any of the following certified components are replaced or added: • X-ray tube housing and high-voltage generator • Beam-limiting assembly • Image receptor • X-ray control unit	Original to Service files. Copies to: • FDA • Manufacturer • State • Hospital
FDA Equipment Locator Card	When system installation is complete	Original to Service files. Copy to manufacturer.

Symbols

Many symbols are used throughout the chapters of this book to represent system functions. This section displays these symbols and explains their meanings.

	Relay		Alarm
	Resistor		Contrast
	Potentiometer		Brightness
	Fuse		Store
	Transformer		Iris Collimator - Close
	On		Iris Collimator - Open
	Off		Motor
	Preparation		Iris Open
	Fluoroscopy		Iris Closed
	Radiography		Closed Slot

	Manual		Open Slot
	Zoom		Rotate Left
	Radiation On		Rotate Right
	Fault	X1	Cable Connector
	Fault Temperature		Snap Shot
	Foot Switch		6 mA Fluoroscopy
	Hand Switch		Transfer, A to B
SOLL	Nominal		Start
IST	Actual		Stop
Vss	Voltage, Peak-To-Peak		Pulsed Fluoroscopy

Notified Body

Our Notified Body is TUV-Rheinland of North America, Inc., number 0197.

Chapter 2 - Safety

Audience

This chapter must be read by Service Engineers, System Users, Equipment Owners, Hospital Administrator, and all other individuals responsible for the safe operation of x-ray equipment.

Disconnect equipment from the power supply before opening and/or removing safety covers.

Warranty Voided

Warranty will not be given for equipment that has been repaired by non-authorized persons, or that has been damaged through misuse.

Electromechanical Compatibility

The equipment is EMC-tested according to EN 60601-1-2, limit class A. It may only be operated in residential areas under the supervision of qualified medical personnel.

Environmental Compatibility

During operation, the system does not produce waste. When the system is decommissioned from use or sold, attention should be paid to relevant disposal regulations.

Radiation Warning

This equipment produces x-rays which are dangerous to operators and others in the vicinity, if relevant safety procedures are not strictly adhered to. Useful and scattered beams can cause serious or fatal injuries to any persons in the surrounding area if the equipment is used by unskilled operators. Take appropriate precautions to avoid exposure to the radiation beam, and radiation leakage from the generator housing.

Only authorized personnel should operate, or direct the operation of, this equipment. Persons become authorized, in part, by becoming completely familiar with, and adhering to, 21 CFR, Subchapter J - Radiological Health; and National Council on Radiation Protection (NCRP) document 33 - Medical X-ray and Gamma-Ray Protection for Energies up to 10 MEV: Equipment Design and Use.

Persons responsible for planning the installation of x-ray equipment must be completely familiar with, and adhere to, NCRP 49 - Structural Shielding Design and Evaluation For Medical Use of X-rays and Gamma-rays of Energies Up To 10 MEV.

X-Ray Control Area

The following distances apply, with the x-ray generator in the normal position, and the C-Arm in the vertical position.

- Image intensifier size: 7-inch (17 cm) 8 feet (2.5 m)
- Image intensifier size: 9-inch (23 cm) 11 feet (3.5 m)
- Image intensifier size: 12-inch (30 cm) 11 feet (3.5 m)

Take care to keep patient radiation exposure to a minimum and to use the lowest-possible dose rates. Maintain the highest-possible focus-skin distance. The stipulated minimum focus-skin distance is 20 cm and is ensured by the design of the generator, with the required special skin cone. Additional objects in the path of the x-ray (e.g. operating table) will lead to an increase in radiation dose.

X-Ray Tube

The x-ray tube has a stationary anode, with dual focus. Here are some specific qualities of the x-ray tube:

- Focal spot size, for fluoroscopy 0.6 mm²
- Radiography 1.5 mm
- Inherent filtration equivalent > 4 mm AL
- Image intensifier electronic mag. factor of 1.5
- 30 / 23 / 15 cm (Cesium Iodide)
- 23 / 15 cm (Cesium Iodide)
- 17 / 20 cm (Cesium Iodide)

WARNING: Ambient temperature greater than 60 degrees centigrade may cause irreversible damage to the x-ray tube.

Grounding

The equipment may only be connected to power supplies with separate equipment grounding.

Bonding

If the equipment is used in combination with other equipment for the examination of the heart or brain, or their proximity, a potential bonding conductor is required for the safety of patients and operators (IEC and VDE regulations).

You must ensure that the x-ray system meets the requirements of DIN IEC 601 part 1, §§ 37 ff (see chap. 1.6), through a program of regular maintenance and periodic inspection. You can find a schedule for periodic inspection in the Technical Manual.

Mobile Stands, and Monitor Carts with integrated components (such as screens, documentation camera and paper image printer) are not AP-version. They may not be used in the presence of flammable gasses.

WARNING: Any third-party devices and components used in combination with the system must comply with the safety requirements according to IEC 60601-1 and/or IEC 60601-1-1 or furnish proof of an equivalent degree of safety. Non-compliance may result in a downgrade of the safety classification of the whole system and invalidation of warranty!

Mechanical and Electrical Warnings

Operate moveable assemblies and parts with caution. Inspect moveable assemblies and parts at the intervals stated in this manual.

Only allow properly trained and qualified service personnel to access any internal parts. Live electrical terminals are deadly! Be sure that line disconnect switches are open (off) and that precautions are taken before opening access doors, removing enclosures and panels, and attaching accessories. Do not remove access covers from the generator, control unit, or main power assembly until the main and auxiliary power supplies have been disconnected. If you fail to follow these instructions, you may be seriously injured or killed.

X-Ray Tube Housing

Tube housings have the following hazards:

1. **High voltage.** Normal operating voltages can be deadly.
2. **Hot oil.** Tube housings contain die electric oil which can reach high temperatures. If the tube housing ruptures due to overload, the oil that leaks out can cause serious burns.
3. **X-ray radiation.** X-ray tubes produce x-radiation that is dangerous and potentially fatal.

Hazards

Flammable Gas

Never use the system in the presence of flammable anesthetics, or other flammable gasses, liquids, or vapors. Gasses and vapors can be ignited by electrical arcs that can occur during the normal operation of power contacts, switches, circuit breakers, and other circuit components.

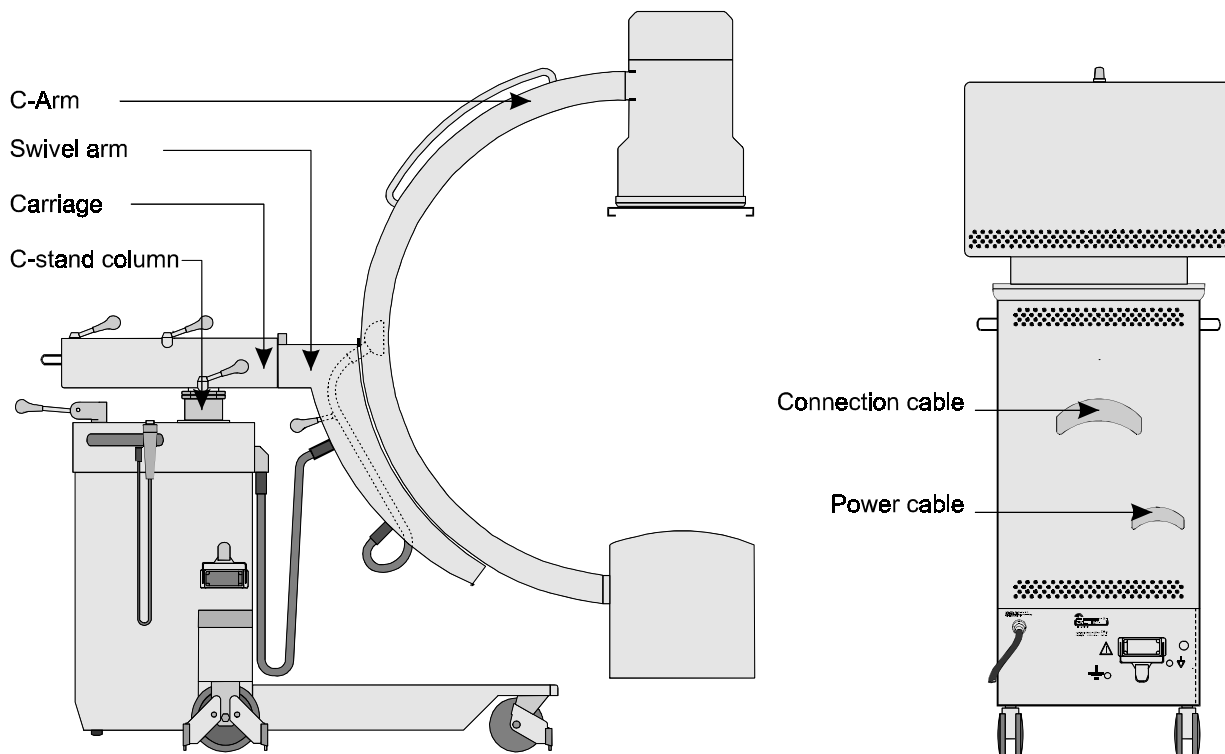
1. **Before the system is turned on.** If flammable liquids, gasses, or vapors are present before the system is turned on, do not unplug the system and do not turn it on!
2. **After the system is turned on.** If flammable substances are detected after the system has been turned on, do NOT turn the system off!. Do NOT touch any of the controls, switches, or knobs! Do NOT unplug the system! Remove all personnel immediately and then ventilate the room. Remove any liquids that are producing flammable vapors to a safe storage area.

Mechanical Movement

Take care to prevent collision with any person or object when using the motorized vertical tube arm assembly, or when manually rotating the C-Arm.

To move the unit, perform the following steps:

1. Bring the C-arm into transport position, as shown in figure [2-1 on page 10](#).
2. Roll-up the power cable and connection cable on the back of the monitor cart.

2-1: C-Arm and Monitor Cart

3. Position the swivel-arm vertically and lock with brake.
4. Swivel the carriage to the center position and lock with brake.
5. Retract the carriage and lock with brake.
6. Retract the C-stand column.

Caution: The floor should not be slanted more than 10° to horizontal.

There is always high voltage in certain components of the system's equipment, even when the system is disconnected from a power source. Touching these components can cause serious injury or even death.

High Voltage Components

- High-voltage transformer and x-ray tube assemblies (110,000 volts)
- Power transformers (220 VAC and 120 VAC)
- Image power supply control assemblies (220 VAC and 120 VAC)
- Generator inverter control (300 Vdc, at 20 Khz)

Performing Internal Service

Two Service Engineers are required to perform any internal service, and one of the Service Engineers must be trained in the Emergency Power Removal procedure. Both Engineers must fully understand equipment circuits and voltages.

Here are some safety rules that must be followed:

- Before removing equipment covers, disconnect the power cord from the power source.
- Never assume that a capacitor is discharged. Use a ground shorting device when working on circuits with capacitors, even when the equipment is disconnected from a power source.
- Make sure that equipment connections are made as described in the Installation section of the manual.

Do not, under any circumstances, remove, by-pass, jumper, or disable safety interlocks.

Before cleaning the equipment, ALWAYS unplug the AC power cable from the wall. If liquid drips into system equipment, it will cause electrical short circuits that may result in electrical shock or fire hazard. Therefore, NEVER allow beverage or food containers to be placed on system equipment.

Never operate the system in a location where conductive fluids, such as water, or saline solution, may come into contact with any part of the equipment, unless the equipment is covered in protective waterproof draping.

Gettering

If the system is stored for more than 6 uninterrupted months, we recommend that you turn it on for at least one hour *before* using it. Doing so will significantly prolong the useful life of the image intensifier.

We also recommend that you keep a logbook of operating hours, getting times, and maintenance details.

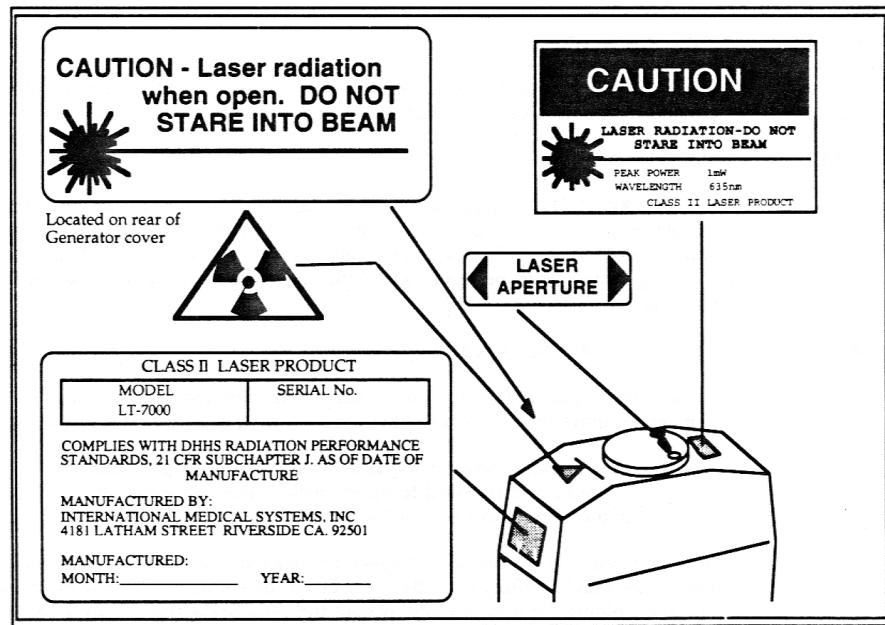
Laser Radiation

The laser alignment device incorporates the use of diode laser modules which emit laser radiation. **Do not, under any circumstances**, look directly at the laser beam or any scattered laser radiation - either with naked eyes or with optical instruments.

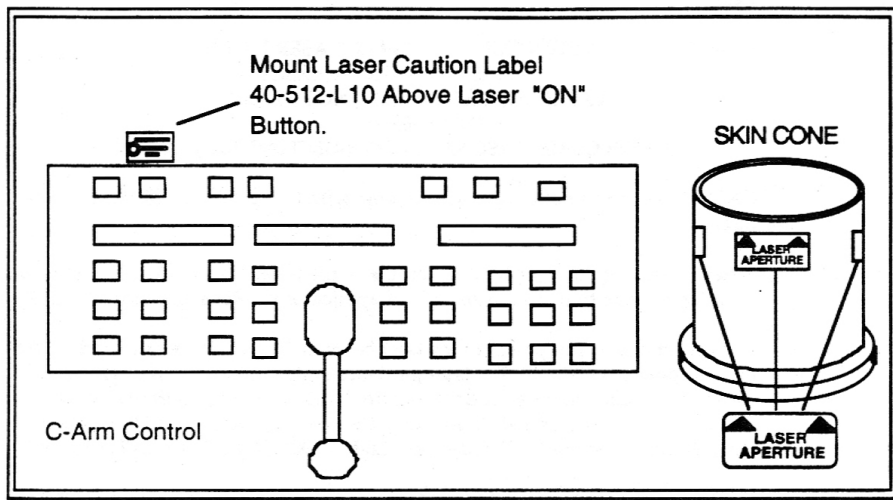
WARNING:
LASER RADIATION
DO NOT LOOK INTO THE BEAM!
LASER CLASS II, IN ACCORDANCE WITH
FDA 21 CFR, Subcategory J, Section 1040.10 - 11
and EN60825 - 1:1994

You must comply with all operating safety precautions when operating the laser device. The maximum output of continuous laser radiation, measured at the laser beam exit is <1 mW. The wavelength of the emitted radiation is 635 nm. The laser device is maintenance-free. However, if adjustment or repair work become necessary, it must be performed by the manufacturer or other authorized persons.

2-2: Position of Visible Laser Light Window and Labels



2-3: Position of Laser Warning Labels on Monitor Cart



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Chapter 3 - General Description

The **ZIEHM 7000** family of x-ray systems have digital processing systems that are designed to extend the advantages of digital image technology to C-Arm Fluoroscopy. Their image enhancement capabilities answer the specific needs of a variety to clinical fluoroscopic applications.

The **ZIEHM 7000** is a mobile x-ray system developed for surgical and diagnostic applications such as fluoroscopy and spot-film radiography. It is not to be used in the presence of flammable anesthetics or other explosive gases.

The **ZIEHM 7000** has been engineered to provide superior quality and performance. Here are some of its outstanding features:

Special Features

- High-frequency generator that produces a precise spectrum of radiation capable of superior penetration.
- Efficient generator design that allows the **ZIEHM 7000** to perform fluoroscopy at maximum kV for up to 20 minutes.
- A 1/2 Dose function that reduces the working dose rate by half.
- Optimum adjustment for various diagnostic requirements made possible by the system's multi-processor.
- Reducing dose by approximately 70% for extended procedures through pulsed fluoroscopy.
- Digital memory featuring Last Image Hold.
- Noise filtering is available through Frame integration.
- Greater resolution is achieved through the image intensifier's electronic focus and magnification.
- Easier system positioning and maneuvering, due to the compact design of the image intensifier.
- Easier cleaning, due to the system's clean design and unique cable arrangement.
- Quick access to fluoroscopy - approximately 35 seconds from powering on.

Image System Design

The 2760 image processing system is modular and allows for quick repair and upgrade. Components were selected for their reliability to promote long service life.

Main components and interconnections are illustrated through block diagrams that are included in Chapter 12.

Imaging Processing

The imaging system is an integral part of the C-Arm and is designed to work hand-in-hand with the C-Arm control. The image processor is activated by the foot switch or hand switch and is controlled by the C-Arm control panel or the monitor cart keyboard. Video is acquired through the C-Arm video camera.

Images are displayed on two high-resolution, black, anti-glare monitors.

Proprietary software improves image quality by:

- reducing noise,
- acquiring images at a true 10-bit grayscale,
- digital acquisition of 1365 H x 525 V,
- digital display of 1287 H x 1049 V, and
- real-time edge enhancement.

The image can be manipulated, stored, or displayed onto the monitors. Images that have been saved to the hard drive can be edited (zoom in, zoom out, enhance edges, crop, etc.).

The imaging software includes these features:

- DSA/RSA/MSA,
- CINE runs at up to 30 frames-per-second (fps),
- Remasking,
- Variable masking,
- Land marking,
- Multi-subtracted masking,
- Subtracted image window and level, and
- Image page display.

Image Page Display

Image page display places 16 images onto the right monitor, for: image transfer during minification, hard copy selection, and other image post processing functions.

Live Images

Live images are displayed during CINE loop acquisition (from 2 to 30 frames) on the right monitor. Acquired images are displayed on the left monitor.

With the purchase of optional Real-Time Edge Enhancement or Vascular Imaging software, the imaging system can provide the following capabilities:

- Digital image rotation
- Circular image masking
- single image delete
- CINE auto store
- Pulse fluoro auto store
- Cine default frame rate
- DICOM 3 interface
- Image Mirror (Reversal) with fluoroscopy off
- Auto magnification mode
- Image store alert
- Subtracted image mask in DSA, RSA, MSA re-registration
- Patient view markers for Right and Left
- CINE run indication in Patient View mode
- LIH off function default setting
- DSA default noise reduction setting

Technical Specs.
VIDEO INPUT

Video input compatibility	RS170
Sampling rate of A/D converter	1365 H x 525 V, @ 21.5 mHz
A/D converter	10 BIT
Acquisition frames per second	30

VIDEO OUTPUT

Video output compatibility	RS170; 1049 High Line Rate
Number of output images	two, 1278 H x 1049 V
Special outputs	Documentation camera: 4 X 525 V@ 1365 H

Video bypass	Video RS170 output automatic @ system power-off (only with software version 06B and earlier)
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Image store format	1024 x 512 x 10-BIT
D/A converters	Three 10-BIT, D/A 16-BITALU

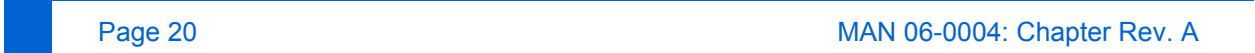
Image noise reduction	2 - 16 frames, real-time 2 - 16 last-image-hold independently programmable
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Memory	Standard: 12 MB; Max: 256 MB
--------	------------------------------

CPU
DISK STORAGE

Type	IDE/ATA Digital disk
Capacity	16 frames (basic) up to 7000 frames (optional)

CINE (Image Loop)	1/2 to 2 fps with chali 4 to 30 fps with DSA
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Chapter 4 - Installation Procedure

This manual is written to Service Engineers. It does not contain any procedures that can be performed by the System Users. Do NOT allow System Users to perform any of the service tasks described in this manual, or any tasks that are not described in the User Manual.

Audience

In order to be qualified to perform the Installation procedures described in this manual, Service Engineers must attend formal training provided by Instrumentarium Imaging Ziehm. Inc. (hereafter referred to as the manufacturer).

Shipping Container

The system is shipped on a single pallet and contains a mobile stand, monitor cart, case assembly (unmounted), and the items listed in the table below.

Unpacking the C-Arm

Item	Quantity
User Manual	2
Technical Manual - C-arm Technical Data - Approval Certificate	2
Foot Switch	1
Hand Switch	1
Connection Cable	1

Carefully inspect the equipment for damage. If you find any damage, immediately report it to the shipping carrier in the form of a damage claim.

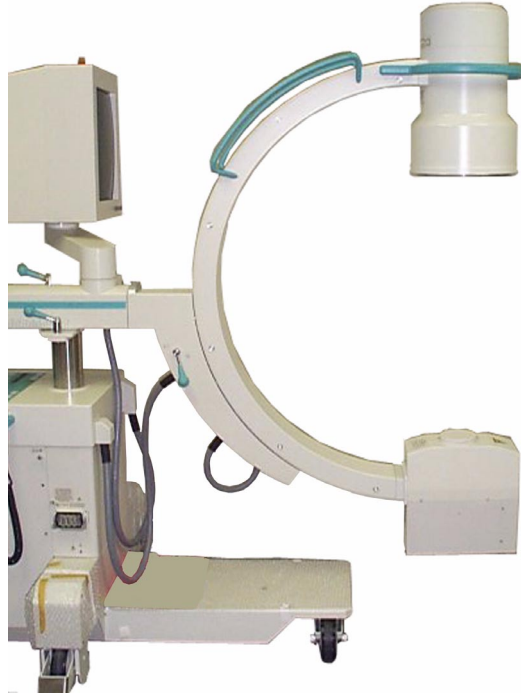
Unpacking

Unpacking of the x-ray system is to be carried out by authorized, qualified personnel.

1. To avoid damage being caused to the equipment by condensation resulting from temperature differences, make sure that all parts of the equipment have reached room temperature before turning the equipment on
2. Remove the outside of the shipping container and inspect for damage.
3. Lower the unloading ramp into position.
4. Loosen all four bolts and remove the monitor cart.
5. Carefully slide the cart towards the off-ramp.
6. Remove the two straps that hold the monitors and take the monitors off the pallet.
7. Remove all of the brackets from the pallet.

8. Loosen the Wig-Wag knob and straighten the C-Arm as shown in figure [4-1 on page 22](#). This will keep the C-Arm from tipping over as it is removed.
9. Remove the metal brackets that hold the C-Arm mobile stand to the pallet. Take care not to scratch the mobile stand.
10. Lift the lever located in the center of the control panel (the hand brake) and carefully move the mobile stand off the pallet and onto the floor.

4-1: C-Arm in the Transport Position



Mounting Monitors ZIEHM 7000

The monitors are the only components that need to be mounted. They are clearly marked Left and Right (as viewed from the front of the monitor cart).

1. Remove the monitor's rear panels.
2. Have a qualified person help you place the monitor assembly onto the mobile cart's mounting surface.
3. There are four screw holes located on the bottom of the monitor case. Attach the monitor case to the cart with four allen screws.
4. Route the mobile cart wiring through the hole in the bottom of the monitor case.
5. Connect the AC power cords and video BNC connectors to their respective monitors (left and right).
6. Connect the **yoke rotation cables** to the X1 (4 pin connectors) on the U305 boards, on the yoke assembly of each monitor.
7. Connect the I²C buss cables (6-pin connectors) to their connectors in the middle of the chassis boards of their respective monitors.

8. Connect the cables to the floppy drive and/or Zip drive (as labeled) mounted in the base of the monitor housing.
9. Attach the ground wires to the rear panel and cart.
10. Install the larger set of four-pin connectors to X1 of the U355A board, which is located behind the monitor chassis board.
11. Apply power to the C-Arm and Monitor Cart and verify that the system works properly. Test All functions. If the system is set-up to be non-fluoroscopic, then confirm that it cannot produce radiation.
12. Re-attach the rear panels and access plates.

ZIEHM 7000 Single Monitor Option (Compact System)

The monitor is the only item that needs to be mounted.

1. Connect the monitor to the monitor cart before turning on the system's power.
2. Plug the monitor cart power cord into a properly-rated and grounded power outlet.
3. Hold the monitor upright and securely attach it to the horizontal arm with the four bolts provided for this purpose.

Note: To perform step 3 safely, you will need another person to help you.

4. Attach the cable connector end from the monitor assembly to the XP1 connector on the mobile stand. Make sure that the cable is draped in a manner that does not interfere with the movement of the mobile stand.

System Interconnect

The monitor cart and mobile stand are connected with a single, heavy-duty cable which attaches at the rear of the monitor cart. Connect the monitor to the monitor cart before turning on the system's power. Plug the monitor cart power cord into a properly-rated and grounded power outlet.

Compact Systems: The Compact system does not require system connection. Simply plug the monitor cart power cord into a properly-rated and grounded power outlet.

AC Power Check

Ensure that the system's AC power cord is compatible with the AC power receptacle. The system must be grounded through the U-shaped grounding prong of the line.

WARNING: Do NOT use a 3-prong to 2-prong adapter, unless properly installed by a licensed electrician. Failure to comply may result in serious or fatal injuries to the System User and other persons in the surrounding area.

Ensure that the AC line voltage is compatible with the power requirements of the system. Line voltage must be set to match service. For voltages above and below 110 VAC, adjust module 10 line voltage.

Verify power input to the Monitor Cart and adjust Module 10 transformer input according to the wall outlet drop-off. (For example, if the wall outlet idles at 115 VAC and drops to 110 VAC when the x-ray system produces fluoroscopy at 90 kV, then tap the Monitor Cart for 110 VAC.)

Compact Systems: Adjust line voltage at the appropriate terminal block, inside the lower rear of the mobile stand.

WARNING: Failure to properly set line voltage taps may result in damage to the system's electronic components.

Check Leakage Current

We recommend that you perform a check of leakage current, using a calibrated leakage meter, in the following manner:

1. Inspect ground leads to ensure that ground connections are solid.
2. Insert the meter (with 100 ohm input impedance) in series with the **ZIEHM 7000** line cord, per the meter manufacturer's instructions.
3. Turn the meter on and verify that leakage current does not exceed 100 μ A, in either normal or reversed line polarity.
4. Connect the black lead of the meter to an exposed metal surface on the **ZIEHM 7000**.
5. Turn the meter on and verify that leakage current does not exceed 100 μ A.

Mechanical Movement

The C-Arm is capable of moving in a 115° arc: 90° from horizontal to vertical, and 25° beyond the vertical plane; rotating in the vertical plane around the horizontal cross arm (+225°), or swinging from side-to-side (+12°). Test C-Arm movement and brakes in the following manner:

1. Release one brake and verify full the full and unrestricted movement of the C-Arm. Secure the brake.
2. Repeat step one for each brake.
3. Release the hand brake on the mobile cart by pulling the handle up, and check that the cart moves freely and can be steered by turning the brake/handle.
4. Turn on C-Arm power at the monitor cart control panel. Raise and lower the C-Arm

4-2: .ON / OFF Keys



Caution: The starting circuit is always powered - even when power is switched off! To completely disconnect from Mains Power, remove the power cord from the wall power outlet.

Follow the instructions found in the CDRH report and record the results into the report.

CDRH Report

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Chapter 5 - Technical Data

This chapter presents technical information for the **ZIEHM 7000** C-Arm, and includes heating and cooling charts. **Introduction**

Caution: Rapid changes to temperature can damage system components. Make sure that all components have reached room temperature before using.

Note: Thermal paper can become discolored at temperatures greater than 40° C, with a relative humidity greater than 60%. At temperatures above 60° C, image contrast can be permanently lost.

Line voltage	230 VAC $\pm$ 10% 50 Hz, 120 VAC $\pm$ 10% 60 Hz
Main fuse of power supply	15 A/220 V, 20 A/110 V
Leak current detection switch	I_N^3 16 A, I_{AN} = 30 mA (specified for 230 V)
Nominal power draw	12 A at 120 V, peak 30 A 6A at 220 v, peak 15 A
Internal power fuse	2 fuses; 15 A at 220 V, 2 fuses; 20 A at 110 V
Line resistance	< 0.6 ohms

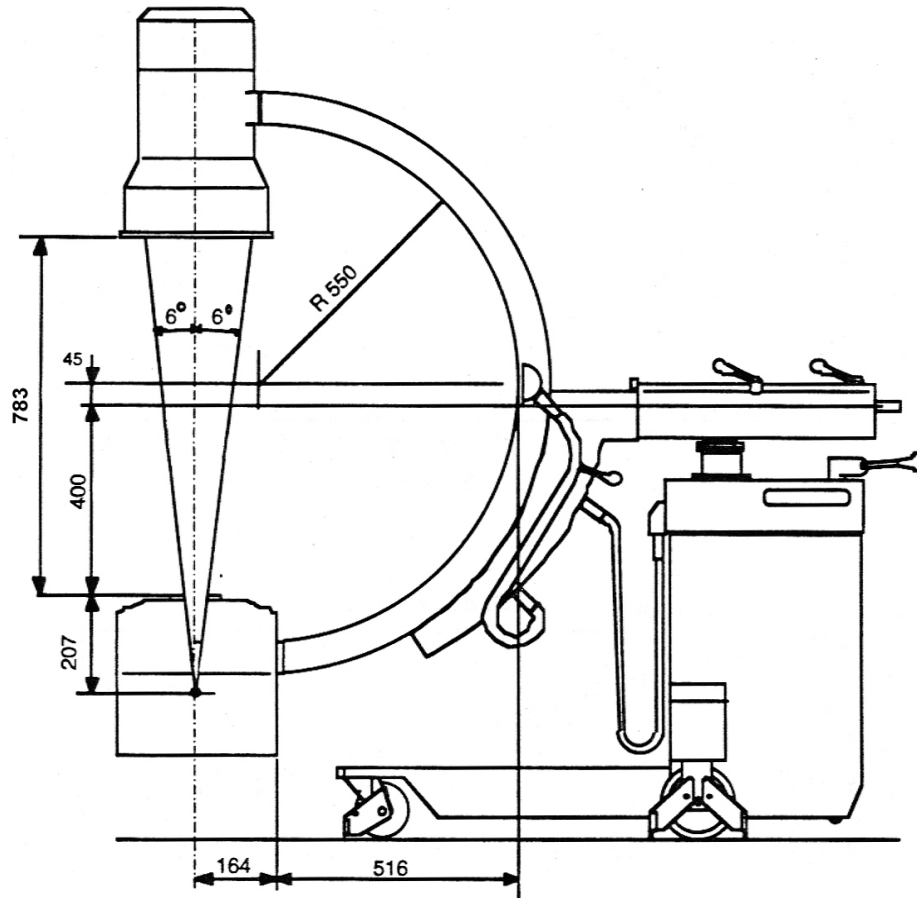
Safety Classification

The **ZIEHM 7000** is classified as Class I, continuous-use, type B equipment. It is not suitable for use in a flammable atmosphere.

Generator output	
- Fluoroscopy	40 kV to 110 kV, 0.2 - 6.0 mA
- Radiography	40 kV to 110 kV, 20 mA
- Operating frequency	20 kHz
Operating values	
- Fluoroscopy	110 kV, 0.2 to 6.0 mA
- Radiography	110 kV, 20 mA
- Exposure time	0.1 - 4.0 seconds, radiographic
Output values	
- Fluoroscopy	550 watts
- Single pulse	880 watts
- Exposure	2200 watts
Nominal electrical output (max.)	220 watts at 110 kV, 20 mA
Current-time reference	20 mA at 0.1 seconds
Radiation safety area	2.5 m, 7" I.I.; 3.5 m. 9" I.I.

X-Ray Tube

5-1: Focal Spot and Reference Axis



Note: More x-ray tube specifications can be found in the X-Ray Tube Data Sheet.

X-ray tube	Double-focus stationary anode
Nominal focal spot	
- Fluoroscopic	0.6
- Radiographic	1.5
Inherent filtration	≥ 4 mm AL
Image intensifier	9 in. = 23/15 cm, 7 in. = 17/10 cm
	Cesium iodide
	Magnification = 1.5 x
Fluoro grid	Pb 8/1, 40
Monitors	
- Picture tube	17 in. = 44 cm
- Band width	20 mHz
- Resolution	32 kHz, 60 - 120 Hz
Storage temperature	-10° C to 70° C (95% rel. humidity)
Working temperature	10° C to 35° C (85% rel. humidity)

WARNING: Do NOT operate system until equipment has reached room temperature. Severe damage may occur!

Mechanism

- Focal spot to image intensifier input screen	97 cm
- C-Arm width (image intensifier to x-ray tube)	75 cm
- C-Arm depth	68 cm
- Orbital movement	115°
- Rotation	± 225°
- Side-to-side (wig wag)	± 12°
- Horizontal	22 cm
- Vertical	13 cm

Weight

- C-Arm	260 kg
- Monitor cart	125 kg

Device: **ZIEHM 7000** C-Arm with x-ray source assembly Maxipuls 3-110

Statement of Compliance

IEC STANDARDS:

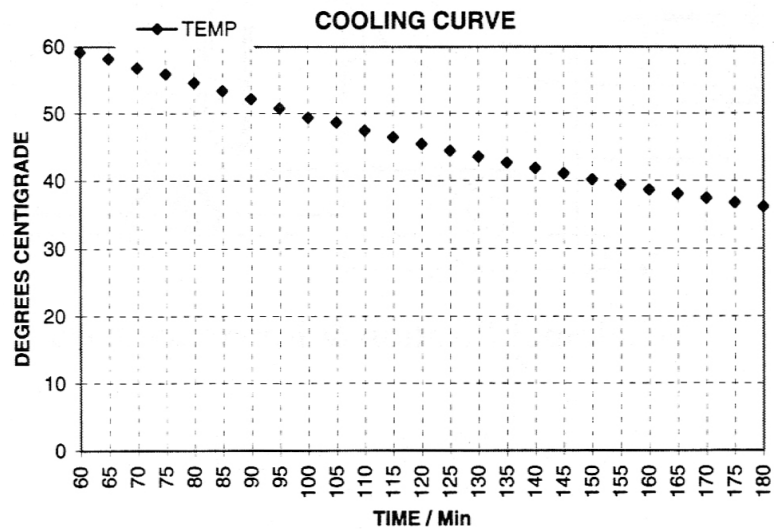
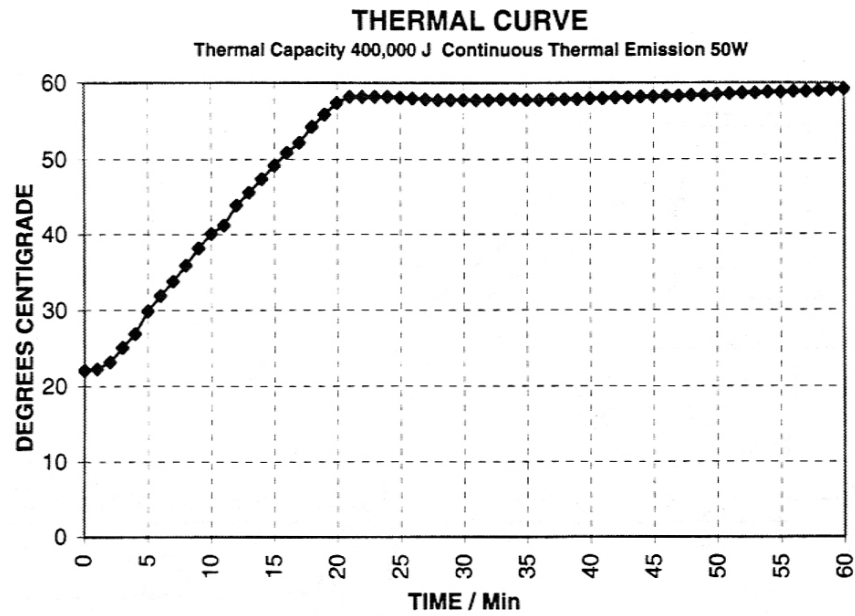
- IEC 601-1: 1990
- IEC 601-2-7: 1987
- IEC601-2-8: 1993
- IEC 601-2-32: 1994

DHHS:

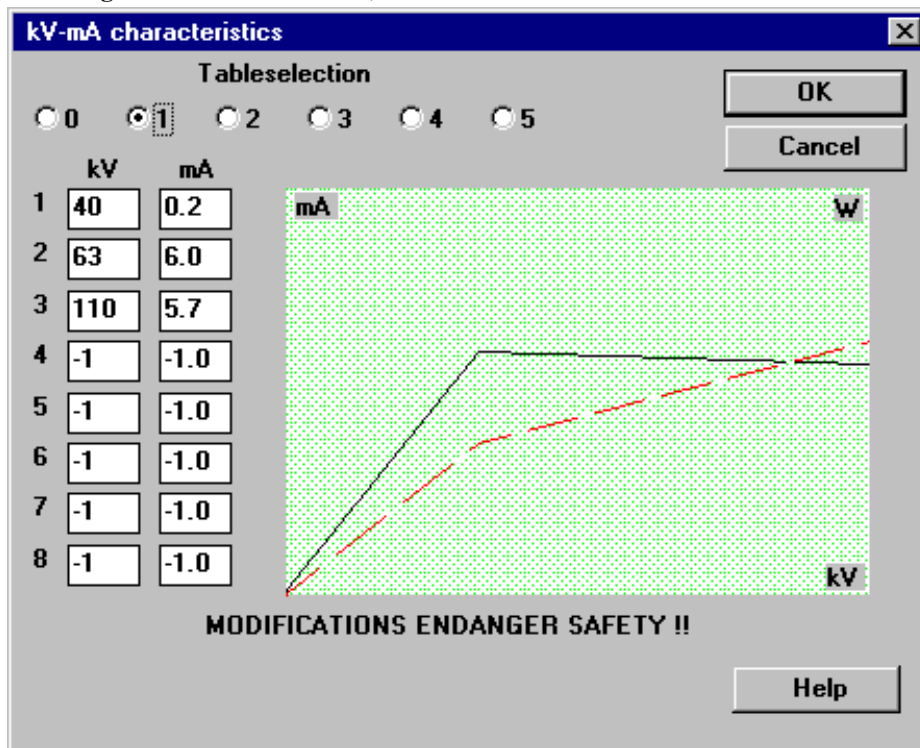
Complies with DHHS radiation performance standards, 21 CFR Subchapter J, as of the date of manufacture.

Instrumentarium Imaging Ziehm, Inc. reserves the right to make changes in specifications at anytime without prior notification.

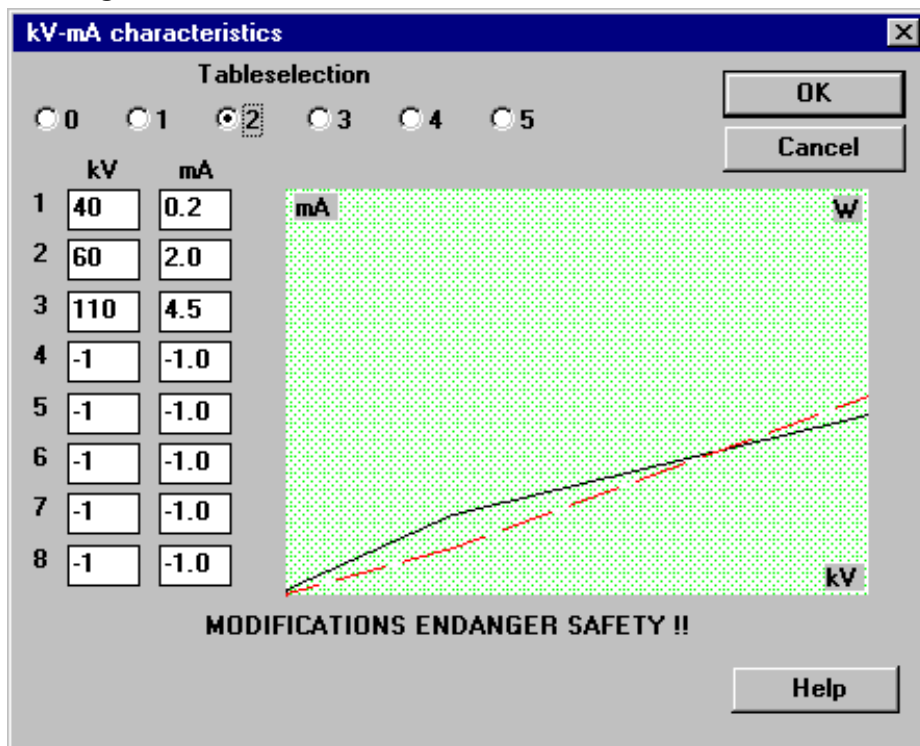
Charts



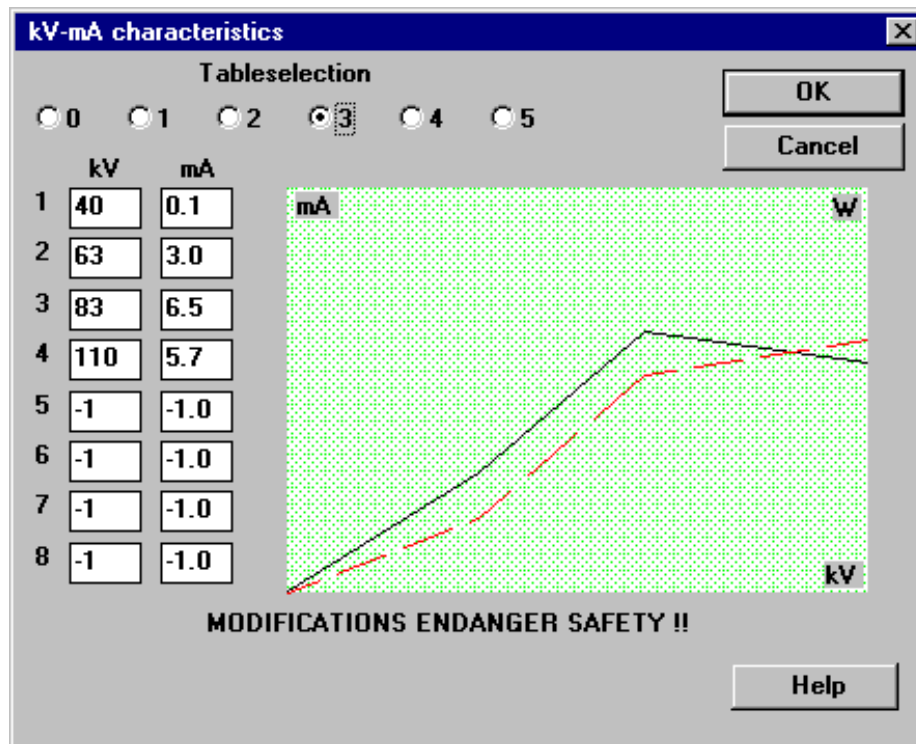
5-2: Program 1: Pelvic - kV/mA, Curve 1



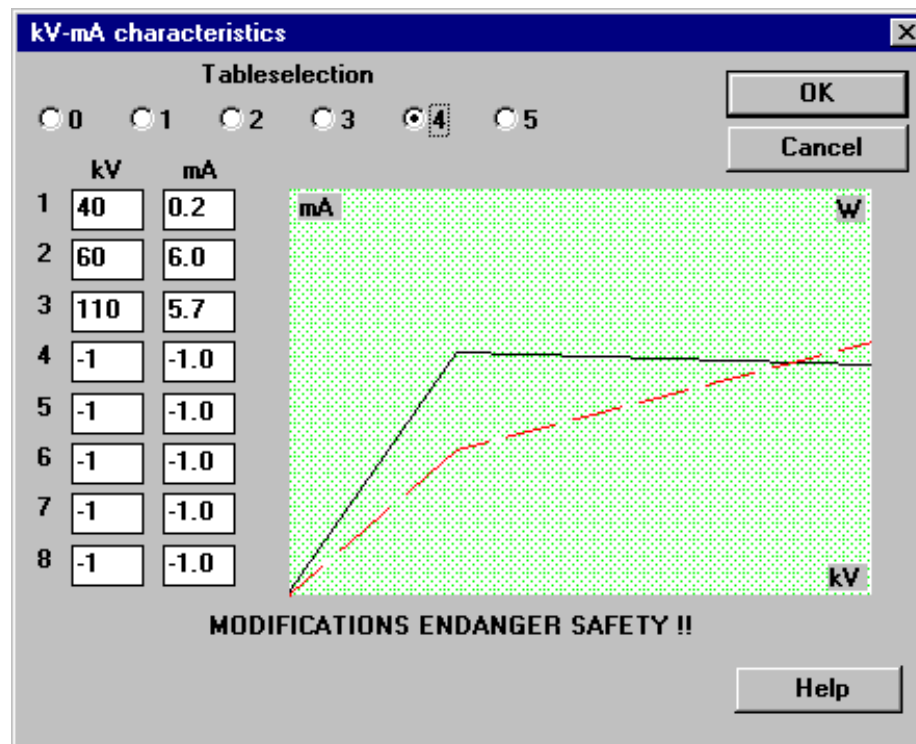
5-3: Program 2: Thorax - kV/mA, Curve 2



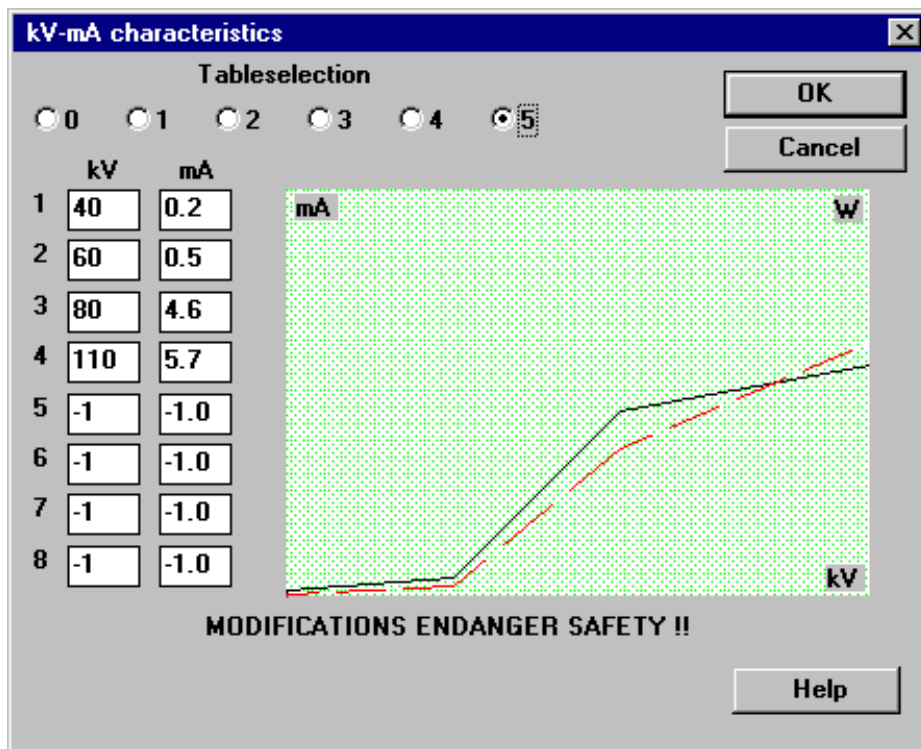
5-4: Program 3: DSA - kV/mA, Curve 3



5-5: Program 4:Soft - kV/mA, Curve 4



5-6: Program 0: Extremities - kV/mA, Curve 5



X-Ray Generator

X-ray generator, Housing and Tube with Beam-Limiting Device

Manufacturer:	Ziehm GmbH
ZIEHM Maxipuls 3-110	
- Total filtration	≥ 4 mm AL
- Focal spot	06./1.5 mm
- Tube type	EP-F 181-0.6/1.5 - 125-60
- Registration no.	BY 287/84/RO
- Target material	Tungsten
- Target angle	12°
- Radiation leakage	< 1 m Sv/h at 110 kV/7200 mAs/h
- Maximum admissible high voltage	110 kV

Dose Rate Control

kV - mA are constant pairs and are directly indicated at the mobile stand (DIN 6811 of January 1975, point 33.1.2).

Chapter 6 - User Manual

This manual provides information for the System User and Service Engineer. System Users must read this manual in its entirety (with the exception of those chapters designated for Service Engineers, only) before being allowed to use an **ZIEHM 7000** C-Arm system.

Audience

X-ray equipment operators must observe all safety rules. Exposure to the x-ray beam must be strictly avoided. Equipment operators, and others in the area, should protect themselves with such devices as lead aprons or shields.

C-Arm Operation

When the x-ray system is first turned on and warming up, the control panel displays zeros, the shutters open to maximum, and the monitor yokes to the normal position. The following default operating mode will be selected:

- **Fluoroscopy**, with automatic dose rate control;
- **Pelvic** fluoroscopic mode;
- the **Full** function;
- **Live Image on the Left Monitor**, with Last Image Hold;
- normal picture size (no magnification);
- 75 kV tube voltage; and
- one second radiographic exposure time.

The control panel keys on the monitor cart, shown in Figure [6-1](#), will light up.

6-1: Keys Activated in Default Mode.



After 30 seconds of filament preheating (approximately), you may begin fluoroscopy by pressing either the hand switch or foot switch. The kV/mA will be automatically adjusted and displayed on the C-Arm control panel display.

Perform the following operational tests:

- Open and close the slot and iris collimators.
- Rotate the slot collimator.
- Reverse the image.
- Rotate the image.
- Select manual kV mode.

- Set kV setting manually.
- Rotate the monitor image using Mobile Stand Control Panel keys.

WARNING: To prevent the camera from being over-driven by high light-levels, do not perform fluoroscopy in the kV manual mode at a kV level higher than needed.

- Use the hand switch to initiate the radiography mode.
- Adjust radiography time from 0.1 second to 4.0 seconds.

Verify that the following results occur:

- During fluoroscopy, the live image appears on the left monitor.
- After fluoroscopy is completed, the last image is held.
- When exposure occurs (either during fluoroscopy or radiography) the amber light on top of the left monitor lights up, and the radiation indicator on the C-Arm control panel lights up.
- When the film cassette is fully inserted in the documentation camera, the cassette indicator light on the monitor cart control panel lights up.

Every month, the System User is responsible for performing the inspections listed in the table below.

	Item	Instructions
1	Radiation Leakage	Inspect for physical damage that could affect radiation shielding, such as the high-voltage generator and shutters.
2	Radiation Switches	Radiation must only release when the exposure switch is pressed; it must immediately stop when not pressed.
3	Exposure Indicator	The warning light on top of the monitor only lights when radiation is emitted.
4	Audible Exposure Indicator	The audible alarm sounds during radiographic exposure, and after five minutes of fluoroscopy.
5	Automatic Dose Control	Check dose control for proper operation, per.
6	Warnings and Caution Labels	All labels must be present and be legible.
7	Line Cord	Look for physical damage to the line cord and connector.
8	Mechanical Cone	Make sure that the mechanical cone is properly installed and secured for a SSD of 30 cm. Verify that the warning label is not defaced.
9	Wheels on Mobile C	Make sure that wheel surfaces are clean, to prevent static discharge.
10	Monitor Cart Casters	Make sure casters are not damaged, and that they are clean.

CDRH Maintenance

For information on requirements imposed by the FDA, please refer to the CDRH Maintenance Report included with the **ZIEHM 7000** Service Manual.

Preventative Maintenance

The System User is responsible for scheduling preventative maintenance and for ensuring that such maintenance is performed only by qualified Service Engineers.

The following list of preventative maintenance activities should be performed at six-month intervals, or whenever the equipment has been subjected to any use or conditions that may compromise the safe operation of the system.

1. kV calibration
2. mA calibration
3. Electrical functions
 - automatic dose rate control
 - mA display at default, low, and normal fluoroscopy
 - radiography time control
 - fluoroscopy terminates after releasing button
 - collimator controls
 - display functions
 - line cord condition; ground
 - cables condition
 - mechanical limits
 - laser power supply voltage tests (as applicable)
 - laser alignment (as applicable)

Verify Automatic Dose Rate

In accordance with CDRH regulations, automatic dose rate must be checked monthly. Power-on the C-Arm in default mode. The control panel must display the following: Fluoro program number one (Extremities): with patient-equivalent filter (25 mm aluminum plus 1 mm copper).

The control panel will also display values that should resemble the following:

1/2 Dose: 67 ± 2 kV / $2.1 \text{ mA} \pm 0.4 \text{ mA}$

1/1 Dose: 70 ± 2 kV / $2.7 \text{ mA} \pm 0.4 \text{ mA}$

Check Beam Centering

Centering refers to the deviation of the beam center to the image receptor. Check beam centering and size periodically, especially if the system hasn't been used for a long time, in the following manner:

1. Place the primary beam shutters in the cone-in position.
2. Look at the fluoro image on the monitor, and check the amount of drift from the center position.
3. Place an object at the center of the image intensifier (like a measuring plate or a center cross hair).
4. Set-up the equipment as follows:

- Focus-Object-Distance (FOD): 90 cm.
- Maximum deviation from center: $\leq 2\%$ FOD.
- Field size shutters: primary shutters must be visible in the monitor.

Note: For more information, refer to Chapter 6.

Description of Symbols

Symbol	Description	Symbol	Description
	AC Alternating Current 417-IEC-5032		Power ON 417-IEC-5007
	Protective Earth Terminal 417-IEC-5019		Power OFF 417-IEC-5265
	Earth 417-IEC-5017		Type B Equipment IEC878-02-02
	Potential Equalization 417-IEC-5021		Dangerous Voltage
	Attention! See accompanying documents. IEC 348		

Mechanical Operation

The mechanical brakes for the C-Arm should always be secured in the locked position, especially when the equipment is in transport.

To adjust the locked position of the handles, lift the handle and move it to the desired position, and then gently release it.

Orbital movement

The C-Arm is capable of 115° of orbital movement: 90° from horizontal to vertical, and 25° beyond vertical. The brake can be released in any of these positions.

Rotation

The C-Arm can be rotated $\pm 225^\circ$ if the horizontal arm is positioned correctly and locked with the brake.

Swivel

The C-Arm can be rotated side-to-side $\pm 12^\circ$ and locked in any position.

Horizontal Movement

When locked in any position, the C-Arm can still move approximately 22 cm, horizontally.

Vertical Movement

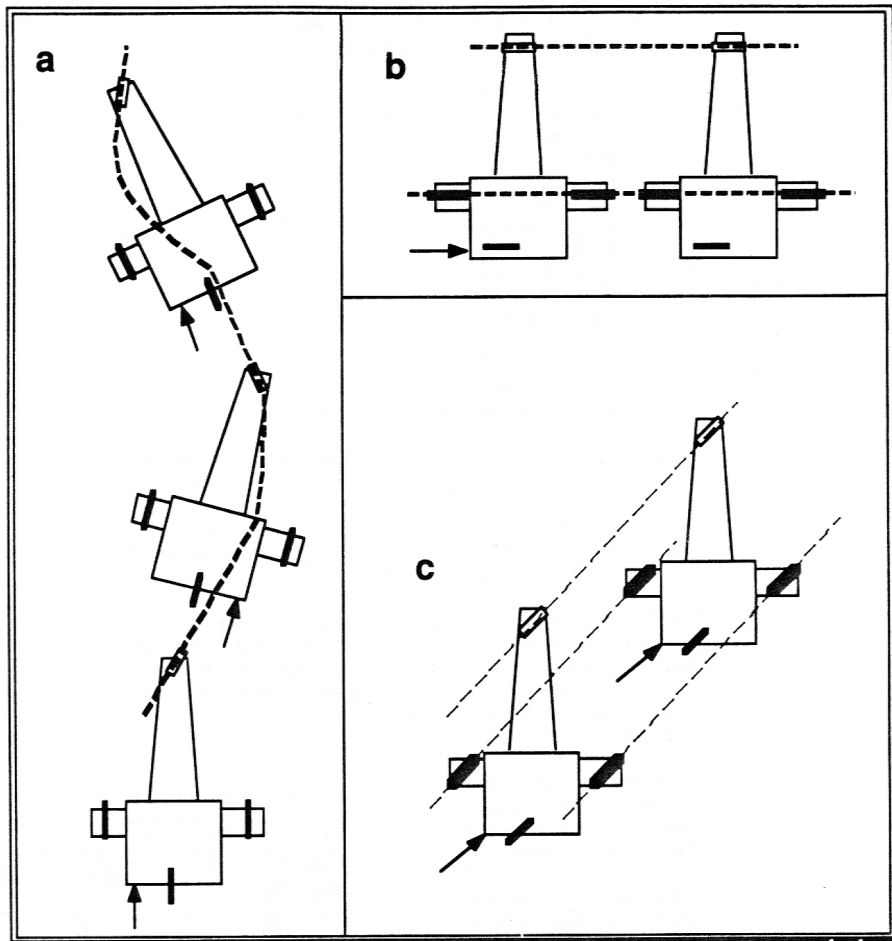
The mobile stand has a motor that can raise and lower the C-Arm up to 43 cm by pressing the Up/Down buttons located on the Mobile Stand Control Panel.

Braking and Steering

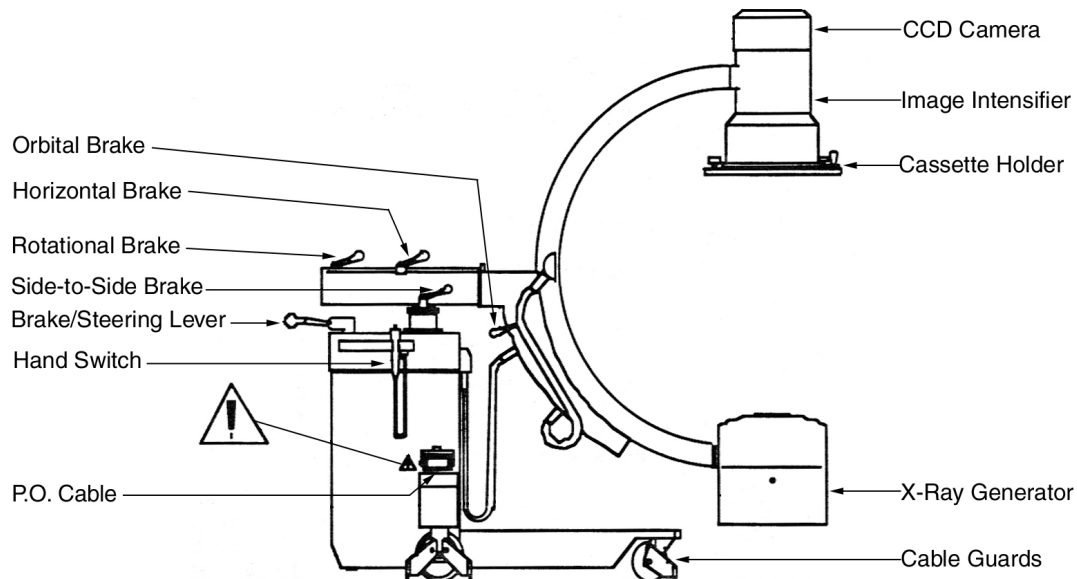
The lever near the Monitor Cart Control Panel is used to both steer and stop. Push down the lever to engage the brake; lift up on the lever to release the brake.

The lever is connected to the cart's two rear wheels. Turn the handle in the opposite direction that you wish to travel (e.g., turn the handle to the left to move the monitor cart right). The single, front wheel swings freely in the direction that you move the mobile stand (see Figure [6-2](#)).

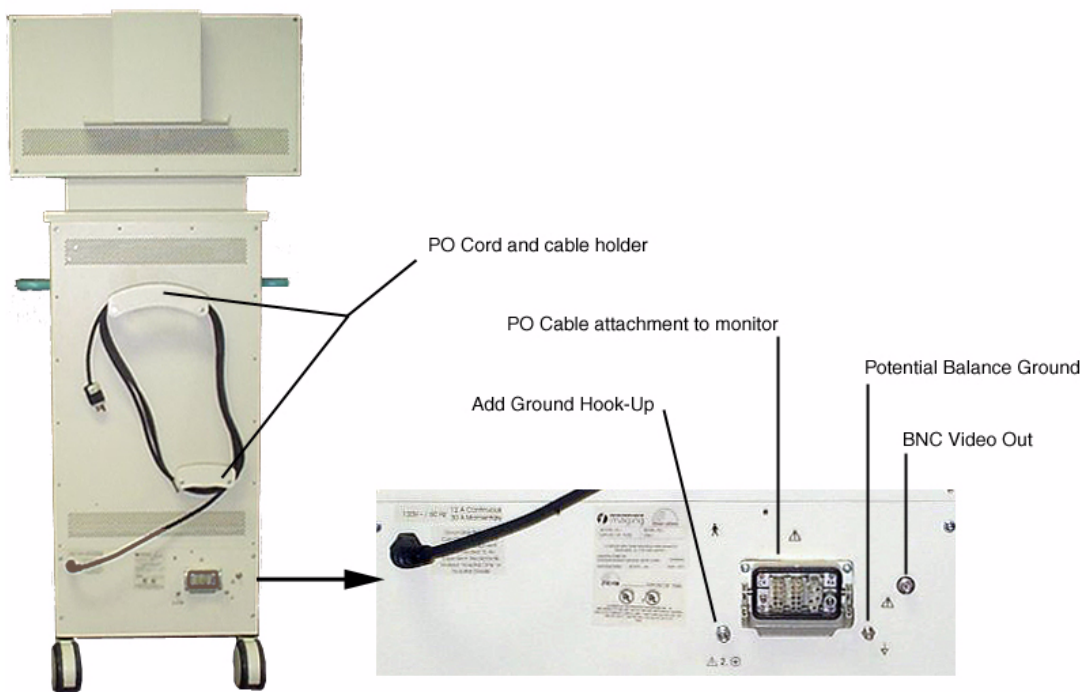
6-2: Steering the Mobile Stand



6-3: Location of C-Arm Major Components



6-4: Rear View of Monitor Cart



At the rear of the monitor cart is a BNC connector for Video Out. The left monitor image carries an RS-170 video signal for use with video recording equipment, external monitors, printers, and so on.

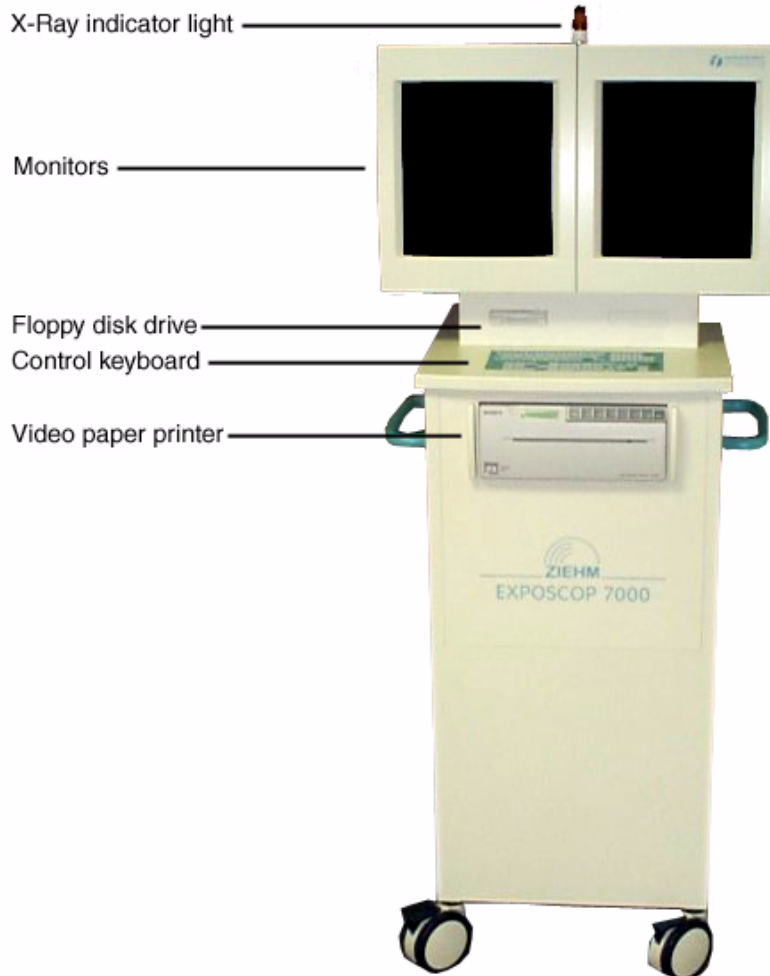
Accessory equipment

When selecting accessory equipment, you must consider:

- the proximity of the accessory to the patient, and
- whether the accessory's safety certification has been performed in accordance with the appropriate IEC 601-1 and/or IEC 601-1-1 harmonized national standard.

Note: Using accessory equipment with a safety rating that is not equivalent to the equipment's, may reduce the safety level of the entire system.

6-5: Front View of Monitor Cart



ZIEHM 7000 Compact System

The Compact system provides all of the standard features of the 7000, but without the need for the monitor cart. The single monitor provides the Last Image Hold function.

The monitor can be positioned on either side of the C-Arm. The System User can view and position the mobile stand by referencing the small video monitor installed in the back of the 17 inch monitor.

6-6: Optional Single C-Mounted Monitor



Introduction

Using the **ZIEHM 7000** to perform fluoroscopy is easy: turn the system on, give the cathode filament around 30 - 45 seconds to warm-up, and press the hand switch or foot switch to view the first image!

The following optional features, described in detail later in this chapter, are also available:

- Several fluoroscopy programs
- Snapshot technique
- Pulsed fluoroscopy
- Manual control of kV
- Image integration for noise reduction
- Zoom (magnification)
- Multi-format image and data storage
- Image reversal
- Image rotation (monitor)
- Iris collimation
- Slot collimation, with rotation
- Real-time edge enhancement
- Documentation rotation (digital)
- Imaging mirroring (after image is acquired)

Basic Operation

Turn on the C-Arm, as described in See “C-Arm Operation” on page 35.

- Fluoroscopy is activated (or, radiation is released) by pressing either the hand switch or the foot switch.
- When you stop pressing the hand or foot switch, the generator stops releasing radiation and the last image is displayed (held) by the left monitor. This image will continue to be displayed until a new fluoroscopic image is obtained.
- Contrast and brightness levels are set at the factory and are, generally, best left alone. However, to change contrast or brightness levels, simply pull out the knob and rotate to obtain the desired effect.

Control Panels

This section describes the functions of the buttons found on the mobile stand and Monitor Cart Control Panels.

6-7: Mobile Stand Control Panel

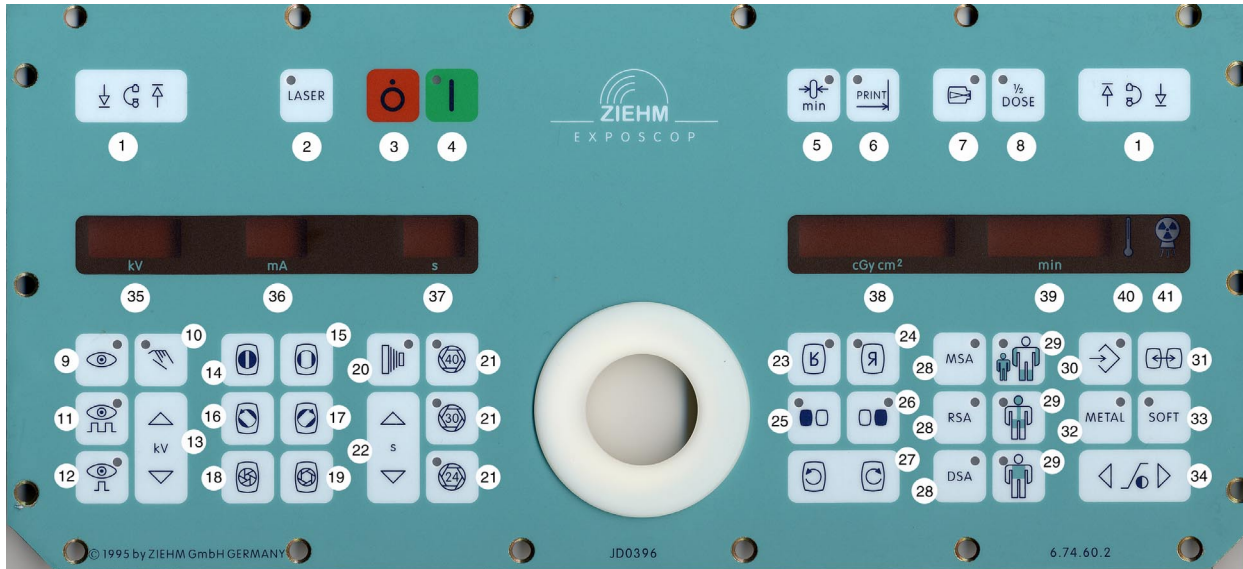
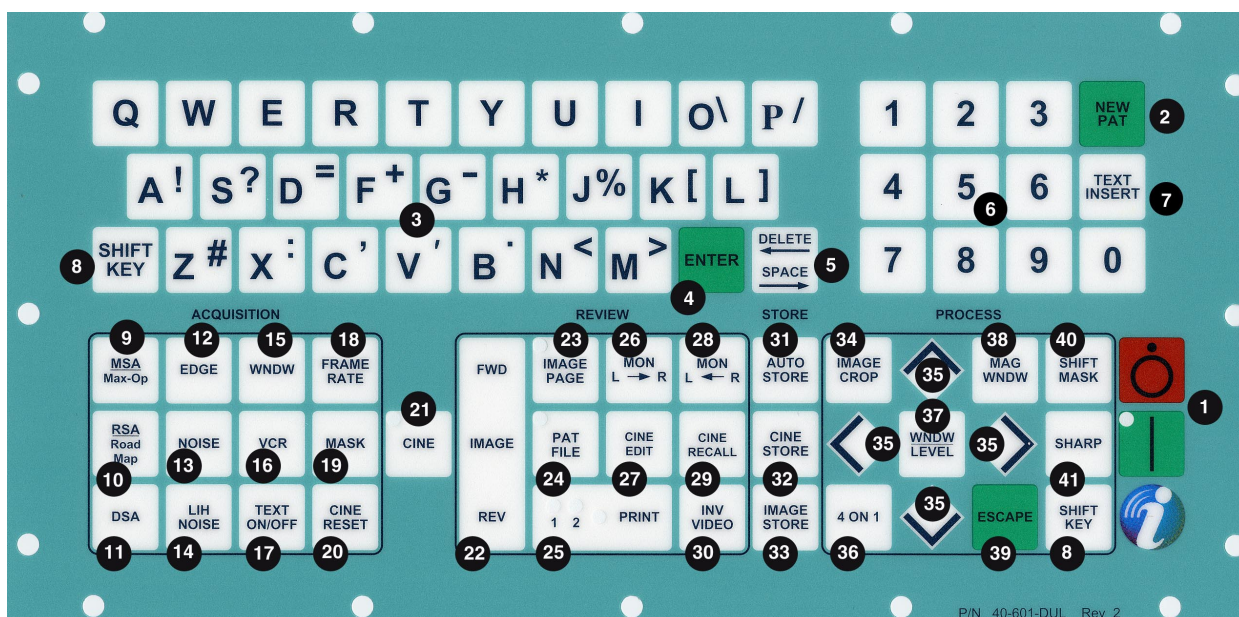


Table 1: Mobile Stand Buttons

To use this table, refer to the circled numbers in Figure 6-7.

No.	Button Description	Page	No.	Button Description	Page
1.	Vertical Position	*	22.	Radiography Time Select	58
2.	Laser ON / OFF	59	23.	Image Reversal: Head to Toe	55
3.	System power OFF	25	24.	Image Reversal: Mirror	54
4.	System power ON	25	25.	Select Left Monitor	54
5.	Radiation Time Reset	58	26.	Select Right Monitor	54
6.	Printer: Paper Copy	59	27.	Image Rotation	54
7.	Magnification/Zoom	54	28.	Subtraction Modes (3)	49
8.	1/2 Dose	53 , 58	29.	Anatomical Programming (3)	49
9.	Fluoroscopy	48 , 65	30.	Image Store: System Disk	56
10.	kV: Manual Mode	54	31.	Live Image Transfer	56
11.	Pulsed Fluoroscopy	48 , 66	32.	Filter: Metal	52
12.	Snapshot	49 , 66	33.	Filter: Soft	53
13.	kV: Manual Adjustment	54	34.	Image Forward/Reverse, Contrast	53
14.	Slot Collimator: Close	55	35.	kV Display	60
15.	Slot Collimator: Open	55	36.	mA Display	60
16.	Slot Collimator: Turn Left	55	37.	Exposure Time Display	60
17.	Slot Collimator: Turn Right	55	38.	Dose/Error Message Display	60
18.	Iris Collimator:	55	39.	Fluoroscopy Time Display	60
19.	Iris Collimator:	55	40.	Temperature Fault Indicator	58
20.	Radiography Mode	56	41.	Radiation Indicator	58
21.	Radiography Field Size	57			

6-8: Monitor Cart Control Panel

Table 2: Monitor Cart Buttons

To use this table, refer to the circled numbers in Figure 6-8.

No.	Button Description	Page	No.	Button Description	Page
1.	Power ON and OFF	60	22.	Image Forward/Reverse	78, 80
2.	New PAT (patient file)	61	23.	Image Page	81
3.	Qwerty Alpha Keyboard	61	24.	Patient Pile	82
4.	Enter	61	25.	Hard Copy	59
5.	Delete and Backspace	61	26.	Image Transfer: Left to Right	84
6.	Number Keys	61	27.	CINE edit	52
7.	Text Insert	64	28.	Image Transfer: Right to Left	84
8.	Shift	60	29.	CINE Recall	52
9.	MSA	49	30.	Inverse Video	84
10.	RSA	50	31.	Auto Store	85
11.	DSA	51	32.	CINE Store	51, 78
12.	Edge	73	33.	Image Store	56
13.	Noise	73	34.	Image Crop	87
14.	LIH noise	73	35.	Arrow Buttons	87
15.	WNDW	74	36.	4 ON 1	89
16.	VCR	79	37.	Window Level	90
17.	Text ON / OFF	74	38.	MAG Window	90
18.	Frame Rate	52, 74	39.	Escape	91
19.	Mask	52, 75	40.	Shift Mask	51, 52
20.	CINE Reset	75	41.	Sharp	91
21.	CINE	51, 76			

Operating Modes

The **Mobile Stand Control Panel** has several buttons that control fluoroscopy. Each button has an indicator light in the upper right-hand corner that lights when the button is pressed and the function is on. These fluoroscopic buttons are listed below and are shown in figure [6-7 on page 46](#).

	Number	Name of Fluoroscopy Button
1.	9	Fluoroscopy
2.	8	1/2 Dose
3.	10	kV: manual
4.	11	Pulsed fluoroscopy
5.	12	Snapshot
6.	28	Subtraction mode: MSA
7.	28	Subtraction mode: RSA
8.	28	Subtraction mode: DSA
9.	29	Organ mode: Extremities and children
10.	29	Organ mode: Head
11.	29	Organ mode: Thorax
12.	32	Filter: Metal
13.	33	Filter: Soft

Note: The tube current is automatically controlled at any given kV value when the Fluoro modes described below are selected. For appropriate kV/mA curves, see Chapter 5.



Fluoroscopy

(Figure [6-7](#), number 9)

Fluoroscopy is the standard mode. It is automatically selected when the **ZIEHM 7000** is turned on.



Pulsed Fluoroscopy

(Figure [6-7](#), number 11)

Pulsed fluoroscopy reduces the effective dose rate. Press the **Pulsed Fluoroscopy** button on the mobile stand and then press the hand or foot switch. Radiation is released for an interval of, approximately, one second. Press the **Pulsed Fluoroscopy** button to return to standard fluoroscopy. When programmed by a service engineer, pulsed fluoroscopy can take up to three pulses per second.

Snapshot

(Figure 6-7, number 12)

Press the **Snapshot** button on the C-Arm control panel and then press the hand switch. Factory presets of 8 mA fluoroscopy and maximum image integration produce images of excellent quality.

Note: Snapshot is only activated by the hand switch; it is **not** activated by the foot switch.



Anatomical Programming

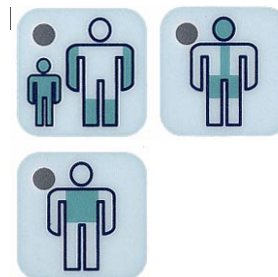
(Figure 6-7, number 29)

The **ZIEHM 7000** is equipped with fluoroscopy buttons for the following body regions:

1. Extremities/pediatrics
2. Head, spinal column, and pelvis, and
3. Thorax

Generally, the best results are achieved by using the appropriate fluoroscopy mode for the indicated body region.

Fluoroscopic



Maximum-Opacified Vascular Subtraction (MSA)

(Figure 6-7, number 28)

Use MSA in conjunction with injected contrast solutions to obtain the best view of the patient's vascular anatomy.

To perform **MSA**, follow these steps:

1. Press the **MSA** button on the Mobile Stand Control Panel (or the **MSA Max-Op** button on the Monitor Cart Control Panel).
2. Press the hand switch or foot switch to start fluoro. The right monitor will display the live fluoroscopy image, the mask will be automatically acquired, and the left monitor will display the subtracted peak-opacified image.
3. When the INJECT message is displayed on the left monitor¹, start the contrast injection.
4. When the vascular anatomy is fully opacified, release the foot switch or hand switch. The left monitor will continue to display the regions of the vascular anatomy that had the greatest contrast during injection.
5. Press the **MSA** button to exit the MSA program.

Subtraction Modes



1. An audible alert is optional.



Re-registration of MSA mask (MAX-OP)

(Figure 6-8, number 9)

If the patient moves during the subtraction procedure, you must realign the mask. Press the **Shift Mask** button on the Monitor Cart Control Panel (Figure 6-8, number 40) and then press the appropriate Arrow buttons to move the mask in the direction desired.

Mask Arrow Buttons

(Figure 6-8, number 35)



To move the Mask, use the **Mask Arrow** buttons located on the Monitor Cart Control Panel, in the following manner:

- Press once to move the mask 0.25 pixels.
- Press and hold the **Shift** button and an Arrow button to move the mask 1.0 pixels.
- Hold an Arrow button down to repeatedly move the mask 0.25 pixels.



RSA Road-Map

(Figure 6-7, number 28), (Figure 6-8, number 10)

To perform RSA Road-Map, follow these steps:

1. Perform standard fluoroscopy and position the patient as needed.
2. Press the **RSA Road-Map** button, either on the Mobile Stand Control Panel, or the Monitor Cart Control Panel, to automatically enable peak opacification for the first part of the procedure.
3. Press the hand or foot switch to start Fluoro. The right monitor displays the live fluoroscopy image. The mask is acquired, and the left monitor displays the subtracted (peak opacified) image.
4. When the INJECT message is displayed on the left monitor¹, start the contrast injection.
5. When the vascular anatomy is fully opacified, release the foot switch or hand switch. The left monitor will continue to display the regions of the vascular anatomy that had the greatest contrast during injection.
6. Press the hand switch or foot switch to display the subtracted road-map image live on the left monitor, and the un-subtracted live fluoro image on the right monitor.
7. Press the **RSA Road-Map** button to exit this mode of operation.

1. An audible alert is optional.

Re-registration of RSA mask

(Figure 6-8, number 40)

If the patient moves during the subtraction procedure, you must realign the mask. Press the **Shift Mask** button on the Monitor Cart Control Panel, and then press the appropriate Arrow buttons to move the mask in the direction desired. To use the Arrow buttons, refer to Mask Arrow Buttons on page 50..

**Subtracted Dynamic Image Acquisition (DSA/CINE)**

(Figure 6-7, number 28)

To perform DSA, follow these steps:

1. Push the fluoroscopy button that corresponds to the region of the patient that is to be examined. (Refer to Anatomical Programming on page 49.)
2. Press the **DSA** button on the Mobile Stand Control Panel. The subtracted image will be displayed on the left monitor.
3. Press the hand or foot switch. The subtracted image will be displayed on the left monitor.
4. When the INJECT message is displayed on the left monitor¹, start the contrast injection.
5. When you have obtained the desired vascular anatomy, release the hand or foot switch. The acquired images will automatically replay in a continuous loop, until you either exit DSA or start a new acquisition.
6. To exit DSA mode, press either the **CINE** button or the **ESCAPE** button on the Monitor Cart Control Panel (Figure 6-8, numbers 32 and 39).

**Protecting Acquired Images**

Pressing the foot switch overrides all other activities. Protect acquired images before starting a new procedure by performing the following steps:

1. Press either the **Store** button on the Mobile Stand Control Panel, or the **CINE Store** button on the Monitor Cart Control Panel (Figure 6-8, number 32).
2. Select **CINE Autostore**, if your system is so equipped. (Figure 6-8, number 31).
3. Press the **CINE Reset** button on the Monitor Cart Control Panel (Figure 6-8, number 20) to select **CINE Protect**.



1. An audible alert is optional.

SHIFT
MASK

Re-registration of DSA mask

If the patient moves during the subtraction procedure, you must realign the mask. Press the **Shift Mask** button on the Monitor Cart Control Panel (Figure 6-8, number 40) and then press the appropriate Arrow buttons to move the mask in the direction desired. To use the Arrow buttons, refer to the Mask Arrow Buttons on page 50.

6-9: Image Acquisition Buttons on the C-Arm

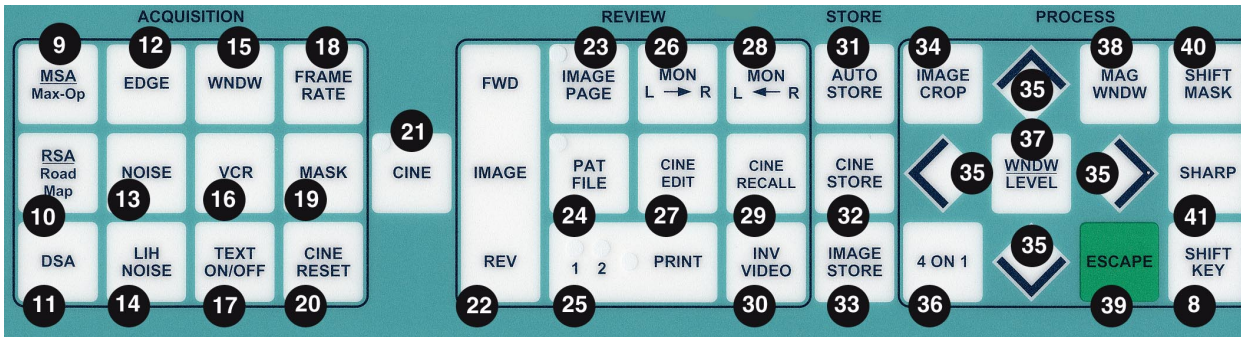


Table 3: CINE Buttons

To use this table, refer to the circled numbers in figure 6-9 on page 52.

No.	Button Description	Button Function
18	Frame Rate	Press to store dynamic images at one to four frames-per-second.
19	Mask	The subtraction mask can be selected while running.
22	Image FWD / REV	Press FWD or REV to display dynamically-stored images.
27	CINE Edit	Press to select the CINE runs for editing.
29	CINE Recall	Press to recall and display a CINE run.
32	CINE Store	Press to protect acquired images onto the dynamic disk.
40	Shift Mask	Press to re-align the mask.

Special Function Buttons

The system is equipped to perform various special functions. These functions are activated by pressing the buttons shown below.

Metal

(Figure 6-7, number 32)

Note: This function is to be used at kV levels of 50 kV or more, and can be used with any other anatomical programming mode.

If any metal is in the path of the x-ray, the displayed image will be too bright and patient detail will be lost. To compensate, press the **Metal** button on the Mobile Stand Control Panel to add contrast to the image.

METAL

Soft/LPD

(Figure 6-8, number 33)

Use this function when you need to take images that require very little penetration, such as revealing skin shapes at an injection site. Press the **Soft** button on the Mobile Stand Control Panel to enter the Soft mode, from any fluoroscopy program. Press the **Soft** button again to return to the fluoroscopy program that you were using before pressing the **Soft** button.

Note: On x-ray systems with serial numbers greater than 2200, the Soft function was replaced by the Large Patient Diameter (LPD) function. The button is still labeled Soft, however the function has been changed.

When the x-ray system is used on a large patient (for example, a patient who weighs more than 300 pounds), kV may run to the maximum setting (110 kV) and the resulting image may be too dark. If this happens, press the **Soft** button to set camera gain to the maximum setting and fully-open the camera iris. Since the image will be very noisy, system noise reduction will automatically engage at the highest setting. In most cases, this will result in an image of diagnostic quality. Noise reduction returns to the previously-selected level when the **Soft** button is pressed again.

**1/2 Dose**

(Figure 6-8, number 8)

One-half dose is the standard mode. It is automatically selected when the **ZIEHM 7000** is turned on.

One-half dose reduces the amount of working dose used by 50 percent. If you need access to full dose, press the **1/2 Dose** button again to turn it off.

**Contrast: Standard Systems**

(Figure 6-8, number 34)

The **Contrast** button performs several functions in the standard system:

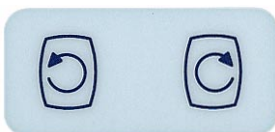
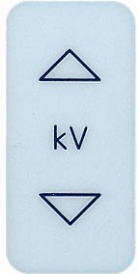
1. When fluoroscopy is on, press the **Contrast** button to adjust image contrast.
2. Press the left arrow to decrease contrast; the right arrow to increase contrast. Contrast can be adjusted a total of six steps: three to decrease contrast and three to add contrast (-1, -2, -3, +1, +2, +3).
3. Press both arrows simultaneously to reset contrast to the factory default setting.
4. When fluoroscopy is off, press the **Contrast** button to recall images, stepping one image forward or backward per press of the button.

**Contrast: With Optional CINE/DSA Module**

The **Contrast** button performs these additional functions in systems that have the CINE/DSA module:

1. When in the CINE/DSA mode, press the **Contrast** button to stop image replay and step one image forward or backward, per press of the button.

Mobile Stand Buttons



- When in the CINE/DSA mode, press both **Contrast** buttons to return to full frame rate; press both buttons again to toggle through all of the available frame rates.

Manual kV Adjustment

Figure 6-7, numbers 10 and 13)

By default, kV levels are controlled automatically depending on the fluoroscopic mode that you select. You may, however, set kV levels manually in the following manner:

- Press the **Hand** button. (Make sure that the button's indicator light is illuminated).
- Press the **kV** button up or down arrow to raise or lower kV level, one step per press. If you need to make a kV adjustment quickly, press and hold the up or down arrow for two seconds.
- To return to Auto Dose mode, press the **Hand** button again.

To lock-in a kV level that has been established by the automatic dose control system, press the **Hand** button.

Magnification (Zoom)

(Figure 6-7, number 7)

The system's image intensifier can magnify images electronically. Press the **Zoom** button on the Mobile Stand Control Panel to magnify the image 1.5 times. The **Zoom** button's indicator light will illuminate to show that zoom is on.

Systems that have the optional Triple Mode image intensifier can zoom 1.5 and 2.0 times. Press the Zoom button once to select level one zoom (1.5). The **Zoom** button's indicator light will illuminate to show that level one zoom is on. Press the Zoom button again to select level two zoom (2.0), The **Zoom** button's indicator light will flash to show that level two zoom is on.

Monitor Selection

(Figure 6-7, numbers 25 and 26)

To select the left monitor, press the **Left Monitor** button. When selected, the button's indicator light will be illuminated.

To select the right monitor, press the **Right Monitor** button.

Compact Systems: The select button for the right monitor is disabled.

Monitor Image Rotation

(Figure 6-7, number 27)

The monitors' image can be rotated clockwise and counter-clockwise by pressing the appropriate **Image Rotation** button. To return the image to its original, upright position, briefly press both buttons simultaneously.

Image Reversal

(Figure 6-7, number 23)

The monitors' head-to-toe image can be flipped upside-down and reversed to a mirror image. To flip the image upside-down, press the **Image Flip** button.

**Image Mirror**

(Figure 6-7, number 24)

To reverse the image right to left, press the **Image Mirror** button.

**Iris Collimator**

The Iris Collimator can be manually opened and closed.

To **open** the Iris Collimator, press the **Iris Collimator Open** button (Figure 6-7, number 19). Each press opens the collimator one step. To make a larger adjustment, press and hold the button down to advance through several steps.



To **close** the Iris Collimator, press the **Iris Collimator Close** button (Figure 6-7, number 18). Each press closes the collimator one step. To make a larger adjustment, press and hold the button down to advance through several steps.



To fully open the iris, briefly press both buttons simultaneously.

Slot Collimator

The Slot Collimator can be manually opened, closed, and rotated.

To **open** the Slot Collimator, press the **Slot Collimator Open** button (Figure 6-7, number 15).



To **close** the Slot Collimator, press the **Slot Collimator Close** button (Figure 6-7, number 14).



To **rotate** the Slot Collimator **counter-clockwise**, press the **Slot Collimator Counter-Clockwise Rotation** button (Figure 6-7, number 16).



To **rotate** the Slot Collimator **clockwise**, press the **Slot Collimator Clockwise Rotation** button (Figure 6-7, number 17).





Live Image Transfer

(Figure 6-7, number 31)

The images from the left and right monitor can be swapped.

Press the **Live Image Transfer** button to transfer the image and text from the left monitor to the right monitor, and the image (without the text) from the right monitor to the left monitor.

Note: Live Image Transfer cannot be activated when the system is releasing radiation.

Compact Systems: This function only works when the monitor cart is connected to the mobile stand.



Image Store

(Figure 6-7, number 30), (Figure 6-8, number 33)

Images can be copied to the system hard drive. When you press the **Image Store** button, the left monitor will display an image number and the message “Store” will blink on the monitor.

Use Image Store to:

- save a live image,
- save the last image held on the monitor,
- save a dynamic image run, when CINE Acquire and Dynamic Image Replay are running, and
- save a single CINE image, when the system is in CINE Step Mode.



Radiography

(Figure 6-7, number 20)

To select spot film radiography, follow these steps:

1. press the **Radiography** button, and
2. press and hold the Hand switch.

The button’s LED will illuminate and an alarm will trigger and remain on throughout the taking of the exposure.

Releasing the hand switch interrupts the exposure. The spot film radiography function is available for re-use ten seconds after an exposure is taken.

Exposure Techniques

Radiography operates at a fixed tube current of 20 mA, and kV is automatically set for optimum penetration. Therefore, the only remaining way to control dose is by adjusting exposure time.

Exposure time can be set from 0.1 to 4.0 seconds.

Radiography Field Size

(Figure 6-7, number 21)

Spot film radiography requires the use of film held against the image intensifier. To attach the film holder to the image intensifier, pull back the holder's spring knob, position the holder on the image intensifier, and then release the knob.

The collimator can be set to three different sizes of film: 24, 30, and 40 cm. However, the 24 cm format is the only size used in the United States.



The Mobile Stand Control Panel has two display windows:

1. The left window displays numeric kV and mA information, and exposure time (S).
2. The right window displays numeric and graphic information regarding dose, fluoro time, and temperature, and includes fault and exposure indicators.

Mobile Stand Displays

6-10: Left Display Window



6-11: Right Display Window



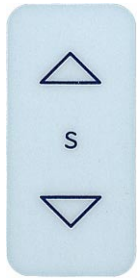
kV Display

The default setting is 75 kV. During fluoroscopy, the **ZIEHM 7000** adjusts kV levels automatically using dose rate control circuitry, unless manually overridden. After fluoroscopy, the last kV value used is stored in the system and is shown in the kV section of the display window.

mA Display

The **ZIEHM 7000** controls mA level in relation to kV level. The mA value is displayed in the left window during live fluoroscopy.

The last value used by the system is stored and recalled when the system returns to fluoroscopic mode. This value will continue to be used until either new kV values are entered or until a new operating mode is selected.



Exposure Time (S)

In Radiographic mode, the system sets the current to 20 mA and an exposure time from 0.1 to 4.0 seconds can be selected using the **Up/Down Arrow** button. This exposure time is then stored and displayed.

Generator Overheating

If the generator overheats, the system will automatically:

1. flash the overheating indicator,
2. revert to fluoroscopy mode, and
3. limit tube voltage 0.5 mA.

If the indicator does not stop flashing, turn off the **ZIEHM 7000** and let the generator cool.

Note: Systems with serial numbers greater than 2300 can be programmed to continue operating fluoroscopy until the maximum heat overload is reached, and then turn off fluoroscopy. The indicator will flash as the generator begins to overheat but, when the generator reaches the maximum heat limit, it will automatically turn off fluoroscopy.



Dose

The Dose indicator displays error messages and, when the optional dose meter is installed, displays dose value in cGY cm².

To reset the Fluoroscopy Time and cGY cm² displays, press the **Min** button.

To reset dose display, press the **Min** button and the **1/2 Dose** button together and hold for at least two seconds.

Fluoroscopy Time

Fluoroscopy and radiography time are displayed in minutes and seconds.



Radiation Exposure Indicator

When radiation is being released, the Radiation Exposure indicator on the right control panel will illuminate.



Audible Alarm

After five minutes of radiation have accumulated, an alarm is triggered and an LED in the **Min** button begins to flash.

To turn off the alarm, press the **Min** button. The LED will continue to flash. To turn off both the alarm and the LED, press and hold the **Min** button.

Note: Pressing and holding the Min button clears Radiation Time and cGY cm² indicator displays.

Laser Aiming Device

The laser aiming device is an option that makes it easier to aim the radiation beam. It produces a light cross that so that you can see where the radiation beam will fall.

Press the **Laser** button to turn the laser on and off. The laser automatically turns off after 60 seconds of use, for your safety.

The laser is a class II laser product, subject to IEC 825 and 21 CFR Subchapter J, 1040. Its peak power is 1 mW, and operates at a wavelength of 635 nm.

WARNING: Do NOT stare into the laser beam! Eye damage may result! The use of optical instruments with this product increases eye hazard.



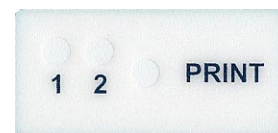
Paper Printer

The paper printer is an optional device that produces paper copies of captured images.

Press the **Print** button to print a copy of an image.

For **ZIEHM 7000** systems equipped with a hard-copy camera and a printer, follow these steps:

1. Press the **Shift** button.
2. Press the **Print Hard Copy** button.



Compact Systems: This function is only available in compact systems that are connected to a monitor cart equipped with a hard-copy camera.

Monitor Cart Functions



Power ON/Off

(Figure 6-8, number 1)

The **ON** button is green and is located in the lower right side of the Monitor Cart Control Panel, as shown in figure 6-8 on page 47.

Pressing the **ON** button to turn on power to the system. The imaging system will perform self-tests, beep a few times, and display READY FOR FLUORO on the left monitor. The system is then ready to acquire images.

The **OFF** button is red and is located just below the **ON** button, as shown in figure 6-8 on page 47. Pressing the **OFF** button turns off power to both the C-Arm and the Monitor Cart.

Shift Key

(Figure 6-8, number 8)

The **Shift Key** button is used with functions keys to activate functions. Holding this button down while pressing a function key activates the function.

Note: Some functions are special options that must be purchased.

Image Crop	Function: Increases the rate at which the shutters open and close by two times. To Activate: Press Image Crop button. Hold down the Shift key and press either the Up/Down or Left/Right arrow buttons.
WNDW/LEVEL	Function: Changes WNDW/LEVEL values at two times the normal rate. To Activate: Press the WNDW/LEVEL button. Hold down the Shift key and press either the Up/Down or Left/Right arrow buttons.
MAG Window	Function: Increases MAG Window movement to two times the normal scroll and pan rate. To Activate: Press the MAG WNDW button. Hold down the Shift key and press either the Up/Down or Left/Right arrow buttons.
Text Insert	Function: Increases the text insert movement of the arrow or text string by more than two times the normal scroll and pan rate.
Alpha Keys	Functions: Some of the keys have secondary functions such as period, colon, less than, greater than, etc. To Activate: Hold down the Shift key and press the key that has the desired symbol. For example: ! is the result of holding the Shift key and then pressing the A key.

Alpha Keys

The Alpha keys are arranged in a standard QWERTY arrangement. Most of the keys perform secondary functions, such as: period, colon, less than, greater than, back slash, and so on.

Number Keys

The number keys are used to enter numeric information, such as patient identification number, date, time, and service values.

Delete/Space Key

(Figure [6-8](#), number 5)

To delete one character, hold down the **Shift Key** button and press the **Delete/Space** button one time. To insert a blank space, just press the **Delete/Space** button.



Enter

(Figure [6-8](#), number 4)

After you have typed-in the desired information, press the **Enter** button to accept the entry.



New PAT (New Patient)

(Figure [6-8](#), number 2)

The **New PAT** button is green and is located in the upper right side of the Monitor Cart Control Panel, as shown in figure [6-8 on page 47](#).

Press the **New PAT** button to enter the New Patient Information screen as shown in figure [6-12 on page 62](#).



6-12: Patient Information Menu

The screenshot shows a terminal window with a black background and white text. At the top, the title 'Patient Information' is displayed in a large, bold font. Below the title, there are several input fields for patient data: 'LAST NAME' with a cursor, 'FIRST NAME', 'MR.', 'M.D.', 'PROCEDURE TITLE', 'FACILITY NAME', 'DATE' (showing '08/16/95'), and 'TIME' (showing '07:24:00'). A line of text reads 'PRESS DOWN ARROW KEY TO ALTER THE FOLLOWING'. At the bottom, it says 'PRESS ESCAPE TO EXIT'.

Enter information line-by-line and then press the **Enter** button to enter the information.

Note: Pressing the Enter button on an empty field causes the cursor to move to the next field.

After the last line has been completed, the screen displays a verification notice in the lower third of the screen to give you an opportunity to review the entered data before it is added to the data file.

Facility Name

Note: By default, Facility Name, Date, and Time are entered by the system.

Press the **Down** Arrow button to move the cursor to the desired line.

6-13: Arrow Buttons



When the New Facility data entry field is highlighted, type in the facility's name and either press the Enter button or use the **Up** Arrow button to move the cursor to the New Patient Information data entry field.

Date

Press the **Down** Arrow button to move the cursor to the Date data entry field. When the field is highlighted, type in the desired information and press the **Enter** button (date format is MM/DD/YY). Use the **Up** Arrow button to move the cursor to the Patient Information data entry field.

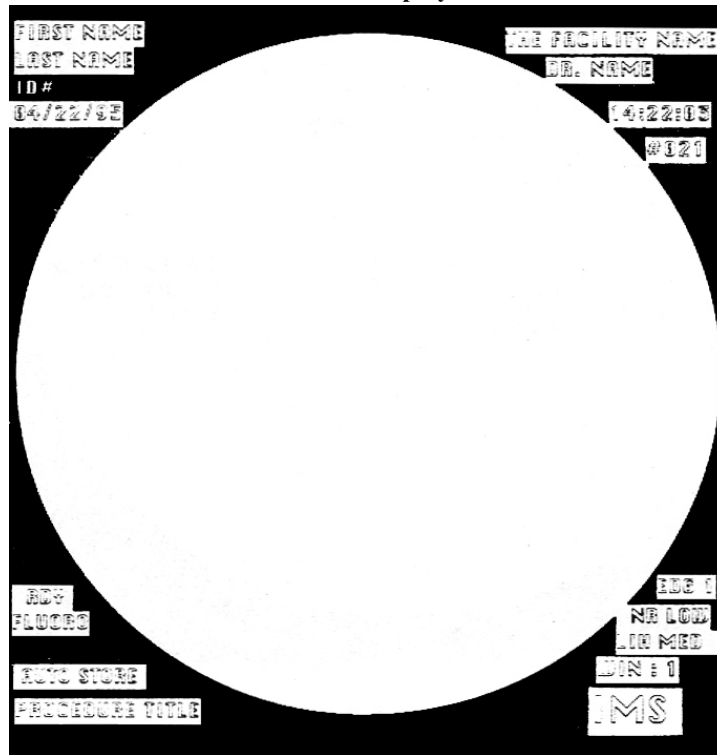
Time

Press the **Down** Arrow button to move the cursor to the Time data entry field. When the field is highlighted, type in the desired information and press the **Enter** button (time format is HH/MM/SS). Use the **Up** Arrow button to move the cursor to the Patient Information data entry field.

To exit the New Patient Information screen *without* saving the information added to the data entry fields, press the **ESC** button.

To exit the New Patient Information screen and save the information added to the data entry fields, press the **Y** key. After the Y key is pressed, the system closes the file and changes the display on the left monitor as shown in Figure 6-14.

6-14: New Patient Information Displayed on Left Monitor



TEXT INSERT

Text Insert

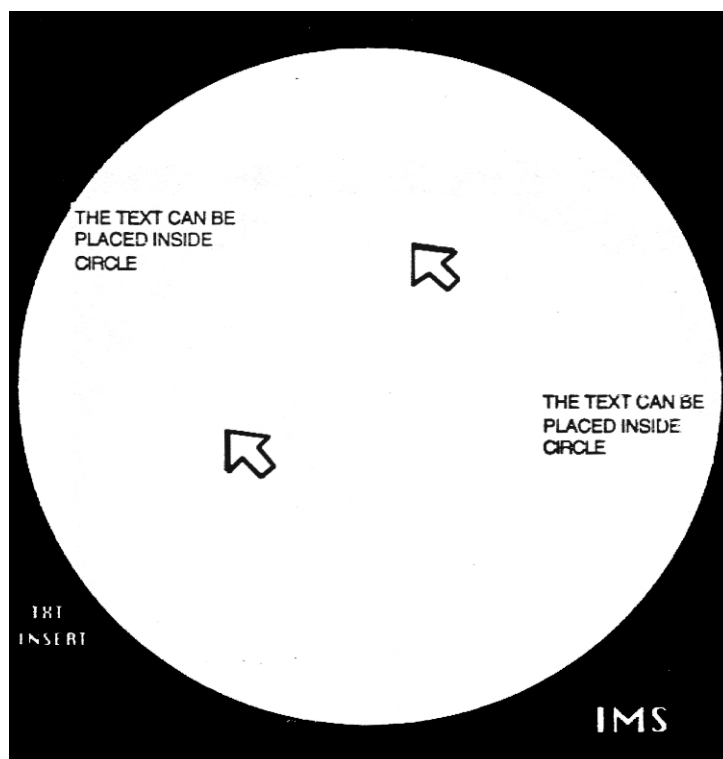
(Figure 6-8, number 8)

The Text Insert function adds an overlay of text to the left monitor. In order for this text to be visible, it must be located within the image circle. To insert text, follow these steps.

1. Press the **Text Insert** button. This will cause an arrow to be displayed in the middle of the image circle, and the message “TXT INSERT” to display in the lower left corner, as shown in figure 6-15 on page 65.
2. Using the Arrow buttons, position the arrow to the desired location. Press **Enter** to store the arrow in that location. You may then move the arrow to a new location for another arrow or start entering text.
3. Press any alphanumeric key to enter a text string. Each string can contain up to three lines of fifteen characters.
4. To save the text overlay, either press the **Store** button or transfer the image to the right monitor.

Note: Text and arrow markers can be repositioned on the image circle by using the Arrow buttons, but only **before** the Enter button is pressed.

6-15: Text Insert

**Right or Left Anatomical Marker**

Anatomical Markers are used to indicate whether the view is left anatomical or right anatomical. They can only be applied to images that are not saved to the hard drive. Markers are displayed on the left monitor, in the upper left corner of the screen.

Press the **R** key to select a Right Anatomical Marker or the **L** key to select a Left Anatomical Marker. The **R** and **L** keys toggle the Markers on and off.

If the image is transferred to the right monitor, the Marker remains visible. If the image is saved while the Marker is displayed, the Marker is saved with the image.

Fluoroscopy

(Figure 6-7, number 9)

The **Fluoroscopy** button is located on the Mobile Stand Control Panel.

Fluoroscopy is the first function that is available after the system is turned on. When the C-Arm is turned on, it performs a self-test of the imaging system and displays the message “RDY FLUORO” in the lower left corner of the monitor. When this message displays, the system is ready to release radiation by pressing either the foot switch or the hand switch. When the pressed switch is released, the image remains on the left monitor. The radiation alert sound can be set to produce an audible sound once every second.

Note: The radiation alert sound can be enabled or disabled by the Service Engineer.

Fluoroscopic Procedures



Pulsed Fluoroscopia

(Figure 6-7, number 11)

The **Pulsed Fluoroscopia** button is located on the Mobile Stand Control Panel.

Pulse fluoroscopia is used to reduce patient radiation dose. Pulsed fluoroscopia turns radiation on and off from one to two times per second, while displaying the last exposure. If the radiation alert is activated, an audible sound will be produced with each pulse of radiation.

To automatically store the last image, press the **Auto Store** button while pulsed fluoroscopia is activated. (The **Auto Store** button is located on the Monitor Cart Control Panel, as shown in Figure 6-8, number 31). The imaging system stores the last image to the patient file when the foot switch or hand switch is released.



Snapshot

(Figure 6-7, number 12)

The **Snapshot** button is located on the Mobile Stand Control Panel. The Snapshot function can only be activated by the hand switch.

Press the **Snapshot** button to activate the function. Press the hand switch to take an 8 mA exposure. The exposure is automatically displayed on the monitor and remains until another snapshot is taken. If the radiation alert is activated, an audible sound will be produced with each pulse of radiation.

Note: Default noise reduction setting is 16-image.



MSA

The **MSA** button is located on the Mobile Stand Control Panel (see figure 6-7 on page 46, number 28). The **MSA Max-Op** button is located on the Monitor Cart Control Panel (see figure 6-8 on page 47, number 9).

MSA provides maximum image opacification of vascular injection regions.

1. Press the **MSA** button on the Mobile Stand Control Panel, or the **MSA Max-Op** button on the Monitor Cart Control Panel to enable maximum opacification.
2. Use the standard fluoroscopia mode to position the patient.
3. Press either the hand switch or the foot switch.
4. When the audible alert activates, start the contrast injection.
5. Press the **Auto Store** button to store the image when the exposure switch is released.
6. Release the exposure switch when a fully opacified image is obtained.

MSA Max-Op

(Figure 6-8, number 40)

If the patient moves during a subtracted procedure, use the Shift Mask function to realign the mask to the patient's new position.

1. Press the **Shift Mask** button.
2. Use the **Arrow** buttons to realign the mask.

Note: Press an Arrow button once to move the mask 1/4 pixel. Hold down the Shift button and press the Arrow button to move the mask one pixel. Press and hold down the Arrow button to move the mask repeatedly.

A rectangular button with a light blue background and a thin grey border. The text "SHIFT MASK" is centered in a bold, black, sans-serif font.**RSA**

(Figure 6-7, number 28 and Figure 6-8, number 10)

RSA subtracts the vascular pathway during live fluoroscopy to aid in the positioning of a catheter or guide wire.

1. Use the standard fluoroscopy mode to position the patient.
2. Press either the **RSA** button on the Mobile Stand Control Panel, or the **RSA Road Map** button on the Monitor Cart Control Panel.
3. Press either the hand switch or the foot switch.
4. When the audible alert activates, start the contrast injection.
5. Release the switch when a fully opacified image is obtained.
6. To continue the Road Map procedure, repeat steps 3 through 5. The subtracted Road Map will continue to be displayed on the left monitor while the right monitor will display an un-subtracted, "live" image.

A rectangular button with a light blue background and a thin grey border. The text "RSA" is centered in a bold, black, sans-serif font. There is a small dark grey circle in the top right corner of the button.A rectangular button with a light blue background and a thin grey border. The text "RSA Road Map" is centered in a bold, black, sans-serif font, with "RSA" on the top line and "Road Map" on the bottom line.**Re-Registering the Mask During Road Map**

(Figure 6-8, number 40)

If the patient moves during a subtracted procedure, use the Shift Mask function to realign the mask to the patient's new position.

1. Press the **Shift Mask** button.
2. Use the **Arrow** buttons to realign the mask.

Note: Press an Arrow button once to move the mask 1/4 pixel. Hold down the Shift button and press the Arrow button to move the mask one pixel. Press and hold down the Arrow button to move the mask repeatedly.

A rectangular button with a light blue background and a thin grey border. The text "SHIFT MASK" is centered in a bold, black, sans-serif font.

**DSA (Digital Subtraction)**

(Figure 6-8, number 11)

DSA is used to create a single, subtracted image, without dynamic image acquisition. It provides simple, fluoroscopic, subtracted imaging, with last image hold. DSA can be used during any fluoroscopic procedure.

When DSA is selected, the imaging system optimizes the CCD camera's operating parameters for subtracted image acquisition, and the imaging system selects values for LUT, Window/Level, Noise Reduction, and other parameters.

1. Press the **DSA** button.
2. Press either the hand switch or the foot switch.
3. When the audible alert activates, start the contrast injection.
4. Release the switch when a fully opacified image is obtained.

Description of the DSA Operation

1. To set kV/mA values for DSA acquisition, perform a scout fluoroscopy of the anatomical region, using the appropriate body-region button.
2. Press the DSA button on the Monitor Cart Control Panel (Figure 6-8, number 11).
3. Press either the hand switch or the foot switch. The C-Arm releases radiation and, after three or four seconds, locks the kV/mA and AGC functions of the CCD camera system to prevent the image from changing due to the injected bolus which might cause density fluctuations in AGC and DOSE.
4. The system starts acquiring the image mask, using high noise reduction.
5. After the mask is acquired, the system displays the real-time image on the right monitor.

Note: During acquisition, image intensity and contrast looks different that during fluoroscopy. This is normal.

6. The left monitor displays the message "INJECT" in the lower center of the screen to indicate that the system has captured a mask and is ready for injection.
7. Press either the hand switch or the foot switch to begin image acquisition. An audible alert activates when acquisition begins, and the system subtracts the live images from the mask and displays the subtracted image on the left monitor.
8. Release the switch when the desired vascular anatomy is visualized.

Re-Registering the Mask During DSA

(Figure 6-8, number 40)

If the patient moves during a subtracted procedure, use the Shift Mask function to realign the mask to the patient's new position.

1. Press the **Shift Mask** button.
2. Use the **Arrow** buttons to realign the mask.

Note: Press an Arrow button once to move the mask 1/4 pixel. Hold down the Shift button and press the Arrow button to move the mask one pixel. Press and hold down the Arrow button to move the mask repeatedly.

A rectangular button with a light blue background and a thin grey border. The text "SHIFT MASK" is centered in a bold, black, sans-serif font.

CINE with DSA

(Figure 6-8, number 21 and Figure 6-7, number 28)

CINE with DSA is used to acquire high quality dynamic subtracted images, which is important when viewing peripheral injections, leg run-offs, femoral arteries, etc.

Note: CINE must be selected before DSA is selected from the monitor cart. If DSA is selected from the Mobile Stand, both CINE and DSA will be activated.

When DSA is selected, the imaging system optimizes the CCD camera's operating parameters for subtracted image acquisition, and the imaging system selects values for LUT, Window/Level, Noise Reduction, and other parameters. Frame rates of 1/2 to 30 frames per second (fps) can be selected, depending on the options included with the system and on the rate that is appropriate for the medical procedure.

1. To set kV/mA values for DSA acquisition, perform a scout fluoroscopy of the anatomical region, using the appropriate body-region button.
2. Press the DSA button on the Monitor Cart Control Panel (Figure 6-8, number 11).
3. Ensure that the frame rate is appropriate. If it is not, press the **Frame Rate** button on the Monitor Cart Control Panel (Figure 6-8, number 18) and set the rate.
4. Press either the hand switch or the foot switch. The C-Arm releases radiation and, after three or four seconds, locks the kV/mA and AGC functions of the CCD camera system to prevent the image from changing due to the injected bolus which might cause density fluctuations in AGC and DOSE.
5. The system starts acquiring the image mask, using high noise reduction.
6. After the mask is acquired, the system displays the real-time image on the right monitor.

Note: During acquisition, image intensity and contrast looks different than during fluoroscopy. This is normal.

7. The left monitor displays the message "INJECT" in the lower center of the screen to indicate that the system has captured a mask and is ready for injection.

A rectangular button with a light blue background and a thin grey border. The text "CINE" is centered in a bold, black, sans-serif font.A rectangular button with a light blue background and a thin grey border. The text "DSA" is centered in a bold, black, sans-serif font. There is a small dark circle in the top right corner of the button.

8. Press either the hand switch or the foot switch to begin image acquisition. An audible alert activates when acquisition begins, and the system subtracts the live images from the mask and displays the subtracted image on the left monitor at real-time rates, independent of the selected image acquisition rate.

Only the subtracted image will be displayed during capture and replay. However, during replay the subtracted image mask can be removed by pressing the **DSA** button on the Monitor Cart Control Panel.

9. Release the switch when the desired vascular anatomy is visualized.
10. To exit CINE/DSA, press the **CINE** button or the **Exit** button.

Storing Images



Storing Images

(Figure 6-8, number 32 and Figure 6-7, number 30)

To store the entire dynamic image acquisition to the hard drive during playback, press either the **CINE Store** button on the Monitor Cart Control Panel or the **Image Store** button on the Mobile Stand Control Panel.

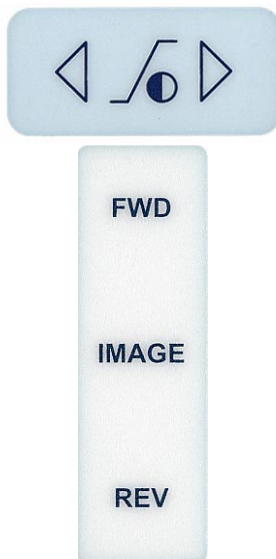
Note: The Image Store button on the Mobile Stand Control Panel will store the CINE run only when in the CINE mode. When not in CINE mode, it will work as a simple Image Store button.

When storing the acquisition at frame rates of 1/2 to 4 fps, the system protects the acquisition and requires less than one second to store it to the hard drive.

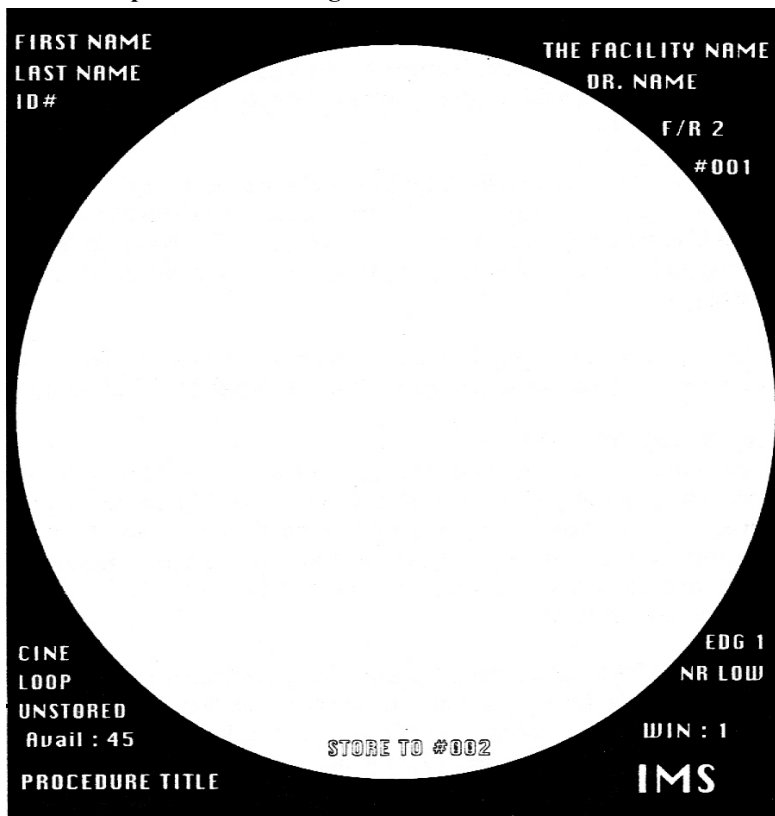
When storing acquisition at frame rates of 8, 15 and 30 fps, the system transfers the images from the extended dynamic image memory to the hard drive, and requires 37.5 seconds to store the images to the hard drive.

Storing Individual Images to the Patient Image File Directory

1. Press the **Image RWD/REV** button on the Mobile Stand Control Panel (Figure 6-7, number 34), or the **Image RWD/REV** button on the Monitor Cart Control Panel (Figure 6-8, number 22). This places the system into a playback mode that steps through images one at-a-time.
2. When image playback has stopped, select the image to transfer to the patient file and press either of the **Image Store** buttons (see: Storing Images on 70).
3. The left monitor will display the message “Stored to XXXX”, which indicates that the image has been copied to the patient file as image number 18, as shown in Figure 6-16.



6-16: Example of Stored Image



DSA Output Look-Up Tables (LUT): Window and Level

Output LUTs can be used to adjust image contrast on CINE replay acquisitions.

1. Select CINE run 1-9 and press the **Enter** button to accept the current CINE replay as the current CINE run.
2. When the image sequence is either loaded or is replaying on the left monitor, press the **WNDW Level** button on the on the Monitor Cart Control Panel (Figure 6-8, numbers 35 and 37).

The image system will now allow changes to image contrast and brightness. Press the **Right** or **Left** Arrow buttons to adjust window size. Press the **Up** and **Down** Arrow buttons to adjust window level.

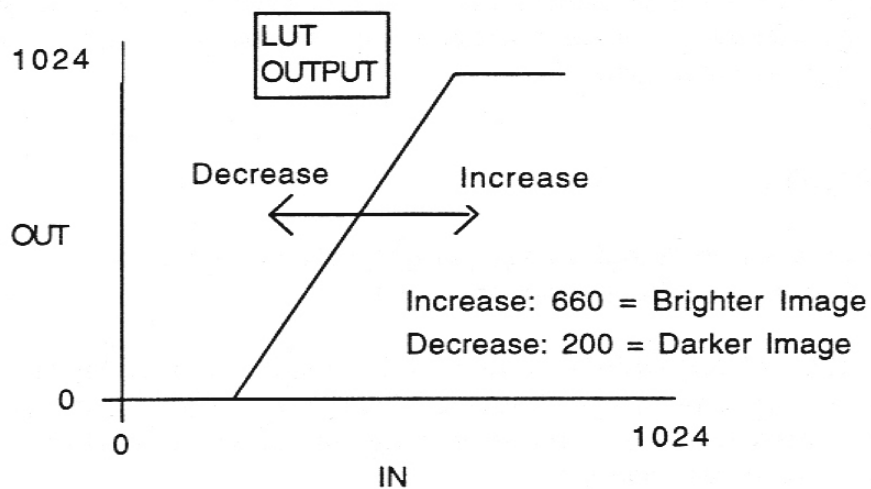
Level Adjustment

The Level of the Output LUT is adjusted to increase the available brightness range, in order to meet a wider variety of image preferences. (See figure 6-17 on page 72 for more detailed information.)

Look-Up Tables



6-17: Level Adjustment

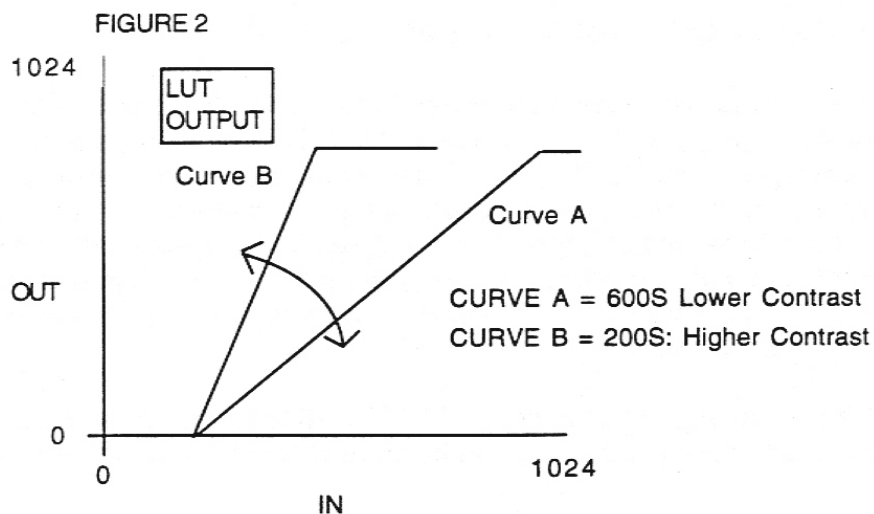


LEVEL: adjust position of curve in OUTPUT LUT. This will increase or decrease image brightness

Size Adjustment

The size of the Output LUT is adjusted from linear to very steep to provide the operator with more control of contrast in the vascular anatomy. Figure [6-18](#) provides more detailed information.

6-18: Size Adjustment



SIZE: Adjusts the Angle of curve in OUTPUT LUT. This will increase or decrease subject Contrast

More Monitor Cart Functions

Edge (Real-Time Edge Enhancement)

(Figure 6-8, number 12)

The optional Edge function sharpens the edges of imaged anatomical structures. It is not a post-processing function and cannot be used to change a previously-stored image.

Four levels of edge enhancement are available:

1 = 20%

2 = 35%

3 = 50%

4 = 65%

The **Edge** button can only be pressed when fluoroscopy is not active. Once pressed, the monitor displays the message “EDGE” in the left monitor.

Best results are obtained when a noise level of at least Edge 1 is used.

EDGE

Noise Reduction

(Figure 6-8, number 13)

The amount of noise in fluoroscopic images can be reduced by three levels: NR Low, NR MED, and NR HIGH. The **Noise** button can be pressed before or during fluoroscopy.

Noise reduction is accomplished by using weighted frame averaging of the current and previous images, which may cause an increase in image lag-time in the video display. It is not a post-processing function and cannot be used to change a previously-stored image.

When the **Noise** button is pressed, the message “NR LOW, NR MED, and NR HIGH” is displayed in the left monitor.

NOISE

LIH Noise (Last Image Hold Noise)

(Figure 6-8, number 14)

The LIH Noise reduction function reduces noise in the image when the radiation switch is released. It is used to reduce noise and distortions that arise from the movement of the C-Arm or patient during a fluoroscopic procedure. It is not a post-processing function and cannot be used to change a previously-stored image.

The system may be configured to apply low noise reduction for live images and a higher level of noise reduction when the foot switch is released.

There are four LIH setting available: LOW, MED, HIGH, and OFF. If you do not wish to have the image displayed on the monitor after the foot switch is released, press the **LIH Noise** button several times until the message “LIH OFF” is displayed on the right monitor.

Note: The LIH function can be disabled in the Service Menu. This must be performed by certified Service personnel.

LIH
NOISE

WNDW

WNDW

(Figure [6-8](#), number 15)

The Window Level function changes the contrast and brightness of the video image by changing the grayscale and brightness within the grayscale. This function provides six levels of adjustment. It is not a post-processing function and cannot be used to change a previously-stored image.

TEXT ON/OFF

Text On/Off

(Figure [6-8](#), number 17)

The Text On/Off function turns the text display on the left monitor on or off. Turning the text display off removes the following text from the monitor: Patient Name and ID, Dr. Name, Facility Name, Procedure Title, Date, Time, and the Instrumentarium Logo. When text is turned off, the system stores the information for each image in the patient record. An example of the monitor display with text turned off is shown in figure [6-19 on page 75](#).

FRAME RATE

Frame Rate

(Figure [6-8](#), number 18)

Press the Frame Rate button to set frame acquisition rate before acquiring images. The left monitor displays the selected frame rate.

The Frame Rate function sets the frame acquisition rate for CINE runs and play back frame rates. With optional packages, the frame rate can be set at 1/2, 1, 2, 4, 8, 15, and 30 fps. The system can acquire images at one rate and replay images at a different rate, at rates below 8 fps. Acquisitions of 1/2 to 4 fps cannot be replayed at 8 to 30 fps.

Frame Rate can be used with stored image loops.

6-19: An Example of Text Off



Mask Selection in DSA Mode

(Figure 6-8, number 19)

The Mask function allows the operator to select a mask.

1. Press the **Mask** button.
2. Press the **Image FWD/REV** button to select a mask number (Figure 6-8, number 22).

MASK

Variable Land Marking in DSA Replay

The Mask function allows the operator to fade bony anatomy into the image to make it easier to determine the position of vascular anatomy.

1. Press the **Mask** button during the replay of the subtraction procedure.
2. Press the **Up Arrow** button to fade the mask away, or press the **Down Arrow** button to fade the mask back in.
3. When the desired mask level is obtained, press the **Frame Rate** button to return to the medical procedure.

CINE Reset

(Figure 6-8, number 20)

By default, images stored at 10, 15, and 30 fps are protected from being overwritten. Press the **CINE Reset** button to remove this protection.

CINE
RESET

CINE Functions



CINE Without Subtraction

(Figure [6-8](#), number 21)

The CINE function selects the dynamic acquisition mode for acquiring and replaying images in a sustained sequence. Images can be acquired at a rate of 1/2 to 30 fps, and can be replayed at either 4 or 30 fps, depending on the optional equipment. Images acquired at 4 fps are stored directly to the hard drive.

With the optional 30 fps package, the images are transferred to the hard drive when the **CINE Store** button is pressed at a rate of 4 fps. Transfer time is 37.5 seconds for 150 images.

When the CINE function is selected, the system does not change its image properties as is the case in the DSA acquisition operation. The C-Arm stays in the fluoroscopic body region that was selected. The CINE function allows the operator the ability to perform procedures such as Cholangiography, Barium Swallows, Urinary Studies, ERCP, or any procedure that requires a sequence of images to be acquired.



The images may be viewed as a subtracted image loop by pressing the **DSA** button on the Monitor Cart Control Panel (Figure [6-8](#), number 11) during replay of the acquired image sequence.

Note: The image quality of subtracted images will not be as good as with the special image properties of the dynamic DSA function selected from the Mobile Stand Control Panel.

CINE Messages

All messages are displayed on the left monitor.

“LOOP UNSTORED”: Indicates that the image loop currently being replayed has not been stored. Press the **CINE Store** button to change the protected run number on the hard drive.

FRAME RATE DISPLAY 1/2-30 F/SEC: Indicates the selected frame rate. To change the frame rate, press the **Frame Rate** button before starting an acquisition or during replay of a captured loop.

“AVAILABLE”: Indicates the number of images that can be stored. When acquiring CINE loop images at a frame rate of 1/2 to 4 fps, the displayed number of images available will decrease as more images are stored. However, when acquiring images at 10 to 30 fps, the displayed number of available images does not decrease as images are stored- it continues to show the maximum number of images that can be stored to the hard drive.

Press the **Image FWD/REV** button to sequence through the images in the CINE run one at a time.

When the hard drive fills to the point that it cannot store at least 50 images, the system will display a message that dynamic image acquisition cannot be started until more space is available. To make room on the hard drive, delete image runs, or patient files.

To exit the CINE function, press the **CINE** button.

CINE Procedure (Image Loop Acquire)

1. Position the C-Arm over the selected anatomical region and select the appropriate body region button. Use fluoroscopy to verify optimum C-Arm positioning.
2. Press the **CINE** button on the Monitor Cart Control Panel (Figure 6-8, number 21).
3. Select the frame rate for dynamic image acquisition: the left monitor will display the message “CINE”, the **CINE** button will light up, and the selected frame rate will display on the left monitor.
4. Press and hold either the hand switch or the foot switch. The left monitor displays the message “INJECT” in the lower center of the screen to indicate that the system has captured a mask and is ready for injection.
5. Start the injection.
6. Continuing holding the exposure switch until the desired vascular anatomy has been visualized.

The acquired images will begin to play back in a continuous loop from the hard drive or from memory, depending on frame rate selected and the system's optional equipment.

At frame rates of 4 fps and lower, the images are stored on the hard drive.
At frame rates of 8 fps and higher, the images are stored in RAM.

Protecting CINE Runs

By default, all images are unprotected. To protect the images, do one of the following:

1. press the **Auto Store** button before or during the CINE procedure,
2. press the **CINE Store** button after the procedure, or,
3. press the **CINE Reset** button after the procedure. (Figure 6-8, numbers 31, 32, and 20).

Acquiring a new dynamic image acquisition

With protection off, press the foot switch.

With protection on, either press one of the **Contrast** buttons on the Mobile Stand Control Panel (Figure 6-7, number 34) or the **Escape** key on the Monitor Cart Control Panel (Figure 6-8, number 39).

If scout fluoroscopy is necessary between runs, press the **CINE** button or the **Exit** button to return to normal fluoroscopy.

Note: All images are stored in a raw format and can be reviewed in un-subtracted format as a dynamic image loop. You can view the loop in subtracted mode on the left monitor by pressing the DSA button. However, image quality may not be acceptable.



**AUTO
STORE**

**CINE
STORE**

**CINE
RESET**

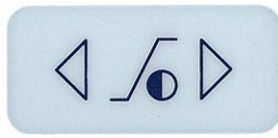


Image Step

During CINE replay, image playback can be stopped and individual images can be reviewed and stored to the patient file.

1. Press one of the **Contrast** buttons on the Mobile Stand Control Panel (Figure 6-7, number 34), or the **Image RWD/REV** button on the Monitor Cart Control Panel (Figure 6-8, number 22). This places the system into a playback mode that steps through images one at-a-time.
2. The message “F/R OFF” will display in the upper right corner of the monitor, indicating that the image loop has stopped and that the operator can now step through the images.
3. Press either button to step through the images. Hold down either button to step through the images at nearly the selected frame rate.
4. When image playback has stopped, select the image to transfer to the patient file and press either of the **Image Store** buttons (see: Storing Images on 70).
5. The message “Stored to XXXX” is displayed on the left monitor which indicates that the image has been copied to the patient file as image number 18, as shown in figure 6-16 on page 71.

CINE Store

(Figure 6-8, number 32)

The CINE store function protects CINE runs that have been stored on the hard drive.

The system allows storage of nine CINE runs for each patient. Each CINE runs may contain the maximum number of images. Press the **CINE Store** button to protect the last CINE run stored on the hard drive.

CINE Auto Store

When CINE is selected and the service option of CINE Auto Store has been activated, CINE runs can be stored automatically by pressing the **Auto Store** button before starting acquisition.

Note: When CINE Auto Store is active, the message “AUTO STORE” is displayed on the left monitor.

CINE Edit and CINE Recall

(Figure 6-8, number 29), (Figure 6-8, number 27)

At one time, CINE Edit and CINE Recall were separate functions. However, with the present software version, pressing either buttons displays the CINE Run Edit/Recall menu and performs the same function.

The menu lists patient and numbered CINE runs. Use the **Up/Down Arrow** buttons to select the desired patient.

Use the **Left/Right Arrow** buttons (located at the top of the screen) to select from one of these four functions: Patient, Runs, Accept, and Delete.



To **Select** a CINE run, do the following:

1. select a patient,
2. select Runs, and
3. enter the number of the CINE run. The CINE run will begin to play back.

To **Delete** a CINE run, do the following:

1. select a patient,
2. select Delete,
3. press the number of the CINE run that you wish to delete, and
4. press Y to confirm deletion. The run will be deleted.

Recording

(Figure 6-8, number 16)

The VCR function records images and plays them back on the monitors.

1. Turn on power to the VCR.
2. Press the **VCR** button located on the Monitor Cart Control Panel. The message “VCR” will display on the left monitor and the VCR will be placed into Record Pause mode.
3. Press the hand switch or the foot switch to start and stop recording.

Note: It takes the VCR one to three seconds to come up to full speed. Therefore, be sure to hold down the exposure switch long enough to capture the desired images.



Auto Record Start

When the VCR is in Record Pause mode, the VCR starts to record each time the hand switch or foot switch is pressed. After replaying the tape be sure to forward the tape to the desired recording position, to avoid erasing important video.

Playback

Fluoroscopy is not possible while the VCR is in playback mode. However, it is possible when the VCR is placed in the following modes: Stop, Rewind, and Fast Forward.

During Playback, Still, and Search modes of operation, the system displays video on the left monitor.

In between recordings there will be brief blank sections, because the VCR takes one to three seconds to come up to operational speed. These blank sections cause the monitor to display noise bars and images that “jump”. To minimize this, make recordings of at least 20 seconds duration.

VCR Operation

Turning off VCR Operation

Press the **VCR** button on the Monitor Cart Control Panel.

Note: If the VCR button is pressed when the power to the VCR is off, the left monitor will display the message "VCR" for a few seconds and then return to the main screen. The VCR must be turned on *before* entering the VCR mode.

DICOM**DICOM Video Capture Review (VCR)**

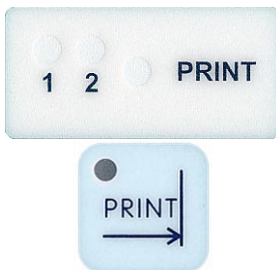
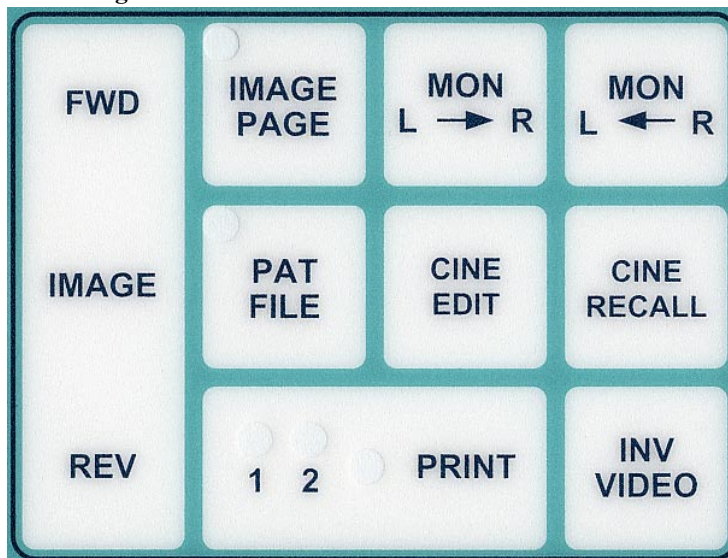
Images stored on the DICOM NT-100 system can be viewed on the right monitor by pressing the **VCR** button.

Image Capture

(Figure 6-8, number 25), (Figure 6-7, number 6)

To store an image to the DICOM NT-100, press the **Print** button on the Monitor Cart Control Panel, or the **Print** Button on the Mobile Stand Control Panel.

Note: For detailed DICOM operating instructions, read chapters 23 and 24 of MAN 06-0004.

**Review Buttons****6-20: Image Review Buttons****IMAGE FWD/REV**

The function of the **Image FWD/REV** button changes depending on the mode the system is in. The button is used to perform the following functions.

- If the CINE mode has been selected, the button allows viewing of CINE run images, one image at-a-time, forward or reverse.
- If Image Page, Patient File, and CINE modes have not been selected, then images from the current patient record can be viewed one-at-a-time. Images are displayed on the right monitor. Hold the button down to recall images from the hard drive at a minimum rate of 1.5 fps.

- In Image Recall mode, with the Image Page displayed on the right monitor, the button moves the selection box within the 16-image page (see figure [6-21 on page 81](#)).
- In Image Recall mode, with the Patient File displayed on the right monitor, the button recall images from the hard drive. Hold the button down to recall images at one to seven fps, depending on system configuration.
- When the 4 ON 1 mode is selected, and the patient file is closed, and no other mode is active, the button moves the selection box within the 16-image display on the right monitor to permit selecting images for the 4 ON 1 on the left monitor.

6-21: Image Collage Page

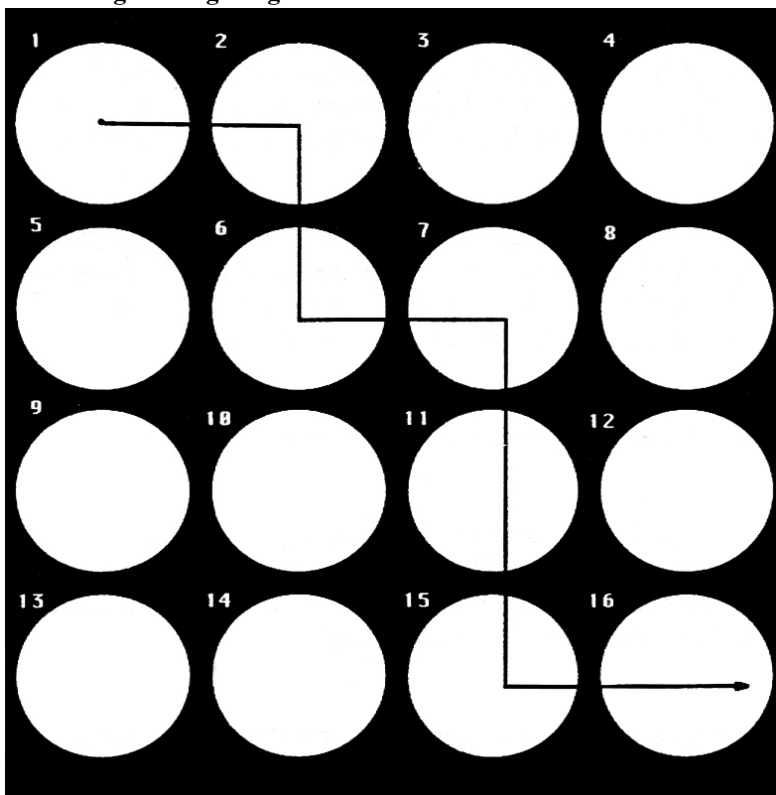


Image Page

(Figure 6-20 on page 80)

The Image Page function displays 16 images on the right monitor with their corresponding image number, as shown above in Figure [6-21](#).

Use the **Image FWD/REV** button, or the **Up/Down, Left/Right** Arrow buttons to move the selection box through the images. When the selection box moves off the screen, in either direction, the system displays another set of 16 images. For example, with images 1-16 displayed, moving the selection box from image 16 to the right will cause the system to display images 17-32.

When the 4 ON 1 function is selected, and the patient file is not selected, the system automatically displays the Image Page.



To exit the Image Page, press the **Image Page** button again, or press the **ESC** key. If escaping the Image Page when the 4 ON 1 function is selected, a single image is displayed on the right monitor and the **Image FWD/REV** button is used to recall images for 4 ON 1.



PAT File

(Figure 6-20 on page 80)

The Patient File function gives the operator control over patient files.

Press the **PAT File** button to displays a list of patient files on the screen, as shown in Figure [6-22](#). Refer to this figure when reading the remainder on this section.

6-22: Example of the Patient File Display

ACCEPPT	VIEW	DELETE	DELETE	COPY
PATIENT	IMAGE	IMAGE	PATIENT	IMAGE

PAT : LAST NAME, FIRST NAME

DR. : DOCTOR

I.D. : ID#

DATE : 08/16/1995 TIME: 13:26:04

PROCEDURE:

CINE RUN = 3: Img Total 031



PAT : LAST NAME, FIRST NAME

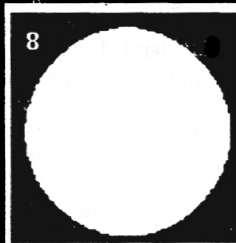
DR. : DOCTOR

I.D. : ID#

DATE : 08/16/1995 TIME: 14:26:04

PROCEDURE:

 Img Total 011



PAT : LAST NAME, FIRST NAME

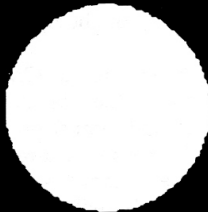
DR. : DOCTOR

I.D. : ID#

DATE : 08/22/1995 TIME: 15:26:04

PROCEDURE:

 Img Total 051



Press the **Up/Down Arrow** buttons to browse patient files. Files are arranged according to the date/time created, and not alphabetically on patient name. When a file is selected, the operator can make hard copies, copy images to floppy disk, and delete files.

The Patient File function includes the following features:

- **Patients File**

If a patient file is being used when the **PAT File** button is pressed (other than the Non-Specified Patient file), then the system makes the patient file the Active Patient, and places an activity box around the patient information.

- **Accept Patient**

To accept a patient file for use, use the **Right/Left Arrow** buttons to highlight the Accept Activity function at the top of the screen, or place the activity box around the patient information, and press the **Enter** button.

Note: If the Image Crop or Window Level functions have been selected, then the Arrow buttons cannot be used to select a patient file. Escape both functions.

- **View Images**

Allows images in a patient file to be viewed without making the file active.
Move the activity box to the desired file and press the **Image FWD/REV** button to view the file's images.

- **Delete Image**

Deletes a single image from the patient file.
Use the **Right/Left Arrow** buttons to highlight the Delete Image box on the activity menu. Press the **Image FWD/REV** button to display the image. Press the **Enter** button.

- **Delete Patient**

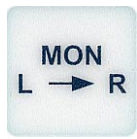
Deletes an entire patient file.
Use the **Up/Down** Arrow buttons to place the activity box around the patient information. Use the **Right/Left Arrow** buttons to highlight the Delete box. Press the **Enter** button.

- **Copy Image**

Copies images from patient file to floppy disk or ZIP drive.
Place a formatted disk into the disk drive. Select the image. Use the **Right/Left Arrow** buttons to select the Copy box from the activity menu on the right monitor.

Note: Image size is approximately 306 KB. One floppy disk will hold four images.

WARNING: Do NOT remove the disk until file transfer is complete! Otherwise, the system will hang-up and will have to be re-booted.



Monitor L To R

(Figure 6-20 on page 80)

Press the **MON L R** button to transfer images from the left monitor to the right monitor.



Monitor R To L

(Figure 6-20 on page 80)

Press the **MON R L** button to transfer images from the right monitor to the left monitor.



CINE Edit and CINE Recall

(Figure 6-8, number 29), (Figure 6-8, number 27)

At one time, these two buttons had separate functions. However, with the present software version, they both bring up the CINE Run Edit/Recall menu and perform the same function.

The menu lists patient and numbered CINE runs. Use the **Up/Down Arrow** buttons to select the desired patient.

Use the Left/Right **Arrow** buttons (located at the top of the screen) to select from one of these four functions: Patient, Runs, Accept, and Delete.

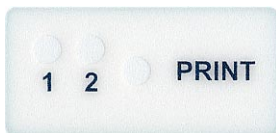


INV Video

(Figure 6-20 on page 80)

The INV Video function can be used with both stored images and real-time fluoroscopy.

Press the **INV Video** button to reverse the light and dark areas of the image and create an image that resembles a film negative.



Print

(Figure 6-20 on page 80)

The Print function transfers images from the monitor to the printer.

Film Documentation Camera

1. Load a film cassette into the Documentation Camera. The Number 1 light will illuminate.
2. Press the **Print** button to begin exposing the film. The Number 2 light will flash until the exposure is complete.

Note: With two-frame cameras, the Number 2 light will illuminate until the Print button is pressed a second time to expose the second film.

3. When all of the camera's light turn off, close the shutter and remove the cassette.

Paper Printer

If the system has both a Document Camera and a printer, hold down the **Shift** button and the **Print** button. If the system only has a printer, press the **Print** button.

Digital Document Rotation

(Figure 6-20 on page 80)

Note: The following only applies to systems that have installed the either the optional Real-Time Edge (RTE) feature or the optional VIM module.

1. Press the **Print** button. The left monitor displays a message directing the operator to press the **Right/Left Arrow** button to perform digital rotation before making a film exposure.
2. Select an image from the PAT View screen and transfer it to the left monitor, or select a single image from the right monitor image collage.
3. Use the Right or Left Arrow button to rotate the image into the desired position.

To bypass the Digital Document Rotation feature, just press the **Print** button again without pressing the **Right/Left Arrow** button.

Image Store

(Figure 6-7, number 30), (Figure 6-8, number 33)

Images can be copied to the systems hard drive. When you press the **Image Store** button, the left monitor will display an image number and the word **Store** (the word Store will blink).

Use Image Store to:

- save a live image,
- save the last image held on the monitor,
- save a dynamic image run, when CINE Acquire and Dynamic Image Replay are running, and
- save a single CINE image, when the system is in CINE Step Mode.



Auto Store

(Figure 6-8, number 31)

The Auto Store function has four modes of operation. Press the Auto Store button to toggle through these functions.

1. Auto Store

Auto Store automatically stores images on the left monitor to the hard drive, when the exposure switch is released.

If there is no more space on the hard drive, a warning is displayed whenever an attempt is made to store an image to the hard drive, whether by using the Auto Store function or the Store function (see figure 6-23 on page 86). To make more room on the hard drive, press the **Enter** button.

When Auto Store is activated, an image is stored every time the exposure switch is released. To make room on the hard drive, patient records must be deleted. For instructions on how to delete patient records, please read Deleting Patient Records on 87.



6-23: Auto Store Warning

2. **Auto Transfer**

Auto Transfer automatically transfers images from the left monitor to the right monitor. The last image on the left (or process) monitor is transferred to the right (or reference) monitor the next time fluoroscopy is initiated.

3. **Auto Both**

Auto Both automatically performs both the functions of Auto Store and Auto Transfer.

4. **Auto Magnification** (available only on system with RTE or VIM installed)

Press and hold the **Auto Store** button until the left monitor displays the message "AUTO MAG". When the exposure switch is released the last image on the left monitor will be magnified and displayed on the right monitor.

To exit Auto Store functions, press the Auto Store button until the display is removed from the left monitor.

Arrow Buttons

(Figure 6-8m number 35)

The Arrow buttons are located on the Monitor Cart Control Panel, in the lower right-hand side. They have several functions, depending on the mode or function that is active.

MAG WNDW: pans and scrolls the magnification window on the left monitor.

IMAGE CROP: closes and opens the electronic collimation shutters.

WNDW/LEVEL: increases and decreases the Window level values.

TEXT INSERT: places text (and/or arrows) in the image circle.

4 On 1: When the Image Page is displayed, the Arrow buttons move the image selection box on the right monitor.



Deleting Patient Records

1. Press the **PAT FILE** button (Figure 6-8, number 24) to open patient files.
2. Use the **Arrow** buttons to select patient file.
3. Select the Delete function from the activity menu at the top of the right monitor. The following message will be displayed on the right monitor:

“Warning: Be sure you are deleting the correct patient record file. You cannot recover deleted patient records or images!”

4. Press the **Enter** button. At the prompt, press the **Y** key. The system deletes all images and patient information for the selected patient file.



Image Crop

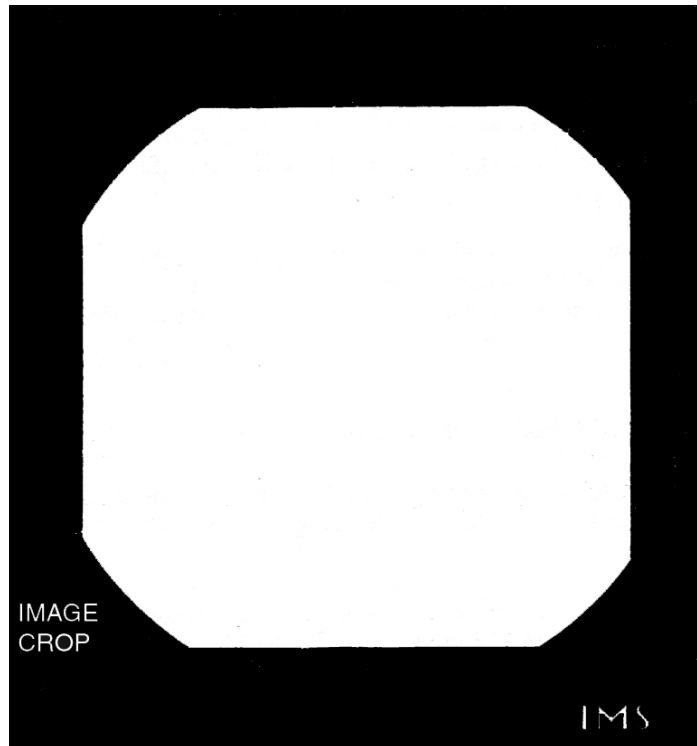
(Figure 6-8, number 34)

The Image Crop function collimates the generator's electronic shutters to crop out unwanted parts of the image.

Press the **Image Crop** button. The screen displays the message “IMAGE CROP” and removes all other text from the screen, as shown in Figure 6-24



6-24:



Positioning the Electronic Shutters

The electronic shutters are located just outside the image circle. The shutters are positioned with the Up/Down, Left Right Arrow buttons in the following manner:

- Close Vertically: press the **Down** Arrow button
- Open Vertically: press the **Up** Arrow button
- Close Horizontally: press the **Right** Arrow button
- Open Horizontally: press the **Left** Arrow button

Store Image Crop

Press the **Image Store** button to store the cropped image.

Transfer Image Crop

When the shutters are positioned correctly, press the **MON L to R** button to transfer the image to the right monitor.

Electronic Shutters

Once the operator has positioned the electronic shutters, this becomes the shutters default position as long as the system is turned on. Once the system is turned off, shutter position returns to the original position of just outside the image circle.

4 ON 1

(Figure 6-8, number 36)

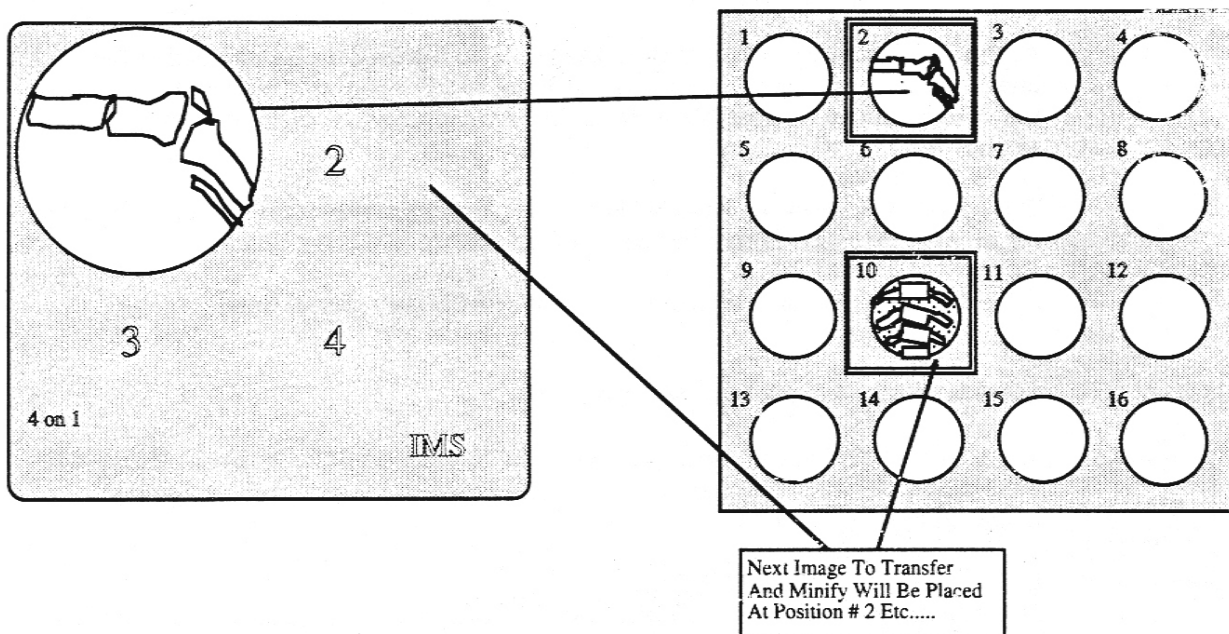
The 4 ON 1 function reduces the size of images so that four images will fit onto the film for documentation printing, thereby eliminating the need for a multi-format camera.

4 ON 1

1. Press the **4 ON 1** button and the following events occur:
 - the left monitor clears,
 - the message “4 ON 1” is displayed on the left monitor,
 - the numbers 1, 2, 3, 4 are positioned on the left monitor to indicate where the images will be placed, and
 - the 16-image page is displayed on the right monitor, with the selection box placed on the first image.
2. Select the desired image from the 16-image page using the **Image FWD/REV** button or the **Arrow** buttons.
3. Press the **MON R L** button to place a reduced copy of the image in position one on the left monitor, as shown in figure 6-25 on page 89.
4. Repeat step three for images two, three, and four.

Note: You can print the 4 On 1 image, but it cannot be stored.

6-25: Example of 4 ON 1




 A rectangular button with a light blue background and a thin border. The text "WNDW" is on the top line and "LEVEL" is on the bottom line, both in dark blue, all-caps font.

WNDW
LEVEL

WNDW (Window Level)

(Figure 6-8, number 15).

Pressing the **WNDW** button changes the contrast of the video image by changing the window of gray scale. It modifies the brightness of the video by changing the level of brightness within the window of gray scale.

When the **WNDW** button is pressed, the left monitor displays a text message, and the W and L values in relative numbers to the level set.

Adjusting WNDW

Press the **Right Arrow** button to decrease the image's relative contrast scale.

Press the **Left Arrow** button to increase the image's relative contrast scale.

Adjusting Level

Press the **Up Arrow** button to increase the image's relative brightness. Press the **Down Arrow** button to decrease the image's relative brightness.

Note: WNDW and LEVEL are post-processing functions post-processing functions and can only be used to change stored images.

Using the Window/Level Function

1. Select an image to be windowed and leveled.
2. Transfer it to the left monitor.
3. Press the **WNDW LEVEL** button. The function adjusts the image contrast and brightness level to a normal range. The image can then be stored to the hard drive, transferred to the right monitor, or printed by the hardcopy camera.
4. Press the **WNDW LEVEL** button again to return the image to it's original contrast and brightness levels.
5. To exit the Window Level function, press the **WNDW LEVEL** button or the **ESC** button.


 A rectangular button with a light blue background and a thin border. The text "MAG" is on the top line and "WNDW" is on the bottom line, both in dark blue, all-caps font.

MAG
WNDW

MAG WNDW

(Figure 6-8, number 38)

The MAG WNDW function magnifies the image by a factor of two or four. The system displays the original image on the left (or process) monitor and the magnified image on the right monitor.

1. Select an image to the right monitor using **PAT FILE**, **IMAGE PAGE**, or the **Image FWD/REV** buttons.
2. Transfer the image to the left monitor using the **MON LR** button.
3. Press the **MAG WNDW** button. The text will be removed from the left monitor, and a window the size of the magnified area will open on the right monitor, displaying the image magnified two times.
4. Move the window on the left monitor by pressing one of the Arrow buttons. When the window has been moved the image on the right monitor will pan and scroll.

5. To increase magnification four times, press the **MAG WNDW** button. The window on the left window will be smaller, representing the area on the right monitor.
6. Press the **MAG WNDW** button to turn off the **MAG WNDW** function and return the image on the right monitor back to normal size with text display. The right monitor will continue to display the last magnified image.

Note: The digitally-magnified image may appear blotchy or pixilized. To minimize this effect, press the Enter button.

Magnified images can be stored to the hard drive, or copied to the paper printer or the file documentation camera.

Sharp

(Figure 6-8, number 41)

The Sharp function increases the edge sharpness of anatomical structures in images. This function provides two levels of adjustment: number 1 increases edge sharpness by 20%, and number 2 by 35%.

The Sharp enhancement is a post-processing function and cannot be used to enhance a live fluoroscopic image.

Press the **Sharp** button to toggle between Sharp Low, Sharp High, and No edge sharpness.



Escape

(Figure 6-8, number 41)

Press the Escape button to exit from most system functions.



The **ZIEHM 7000** displays error messages in the **cGY cm²** window and activates an audible alarm. Error codes consist of the letter **E** followed by a number, such as **E 16**. If there are multiple errors, the system displays them sequentially.

Error Codes

There are three types of error messages:

1. cautions at start-up
2. errors at start-up, and
3. errors during normal use.

Cautions at start-up

Cautions at start-up indicate faults that do not disable the system. Briefly press the hand switch or foot switch to erase the caution message and de-activate the alarm.

Errors at start-up

Errors at start-up indicate faults that disable the system. Write down the error code for possible future reference.

Depending on the type of problem, you may or may not be able to use the system. If the error will not clear by pressing the foot or hand switch, then you must call Customer Service for equipment diagnosis and repair.

Errors during normal use immediately stop radiation and prevent any attempt to use radiation. You cannot erase the message or de-activate the alarm.

Table 4: List of Error Codes

Code	Type	Message
E16	Caution	Hand switch 1 activated during start-up.
E17	Caution	Foot switch 1 activated during start-up
E18	Caution	Hand switch 2 activated during start-up.
E19	Caution	Foot switch 2 activated during start-up
E20	Error/Fault	Cable defect hand or foot switch
E21	Caution	With compact unit, yellow monitor light defective
E22	Warning	Call Customer Service.
E23	Warning	Call Customer Service.
E24	Warning	Call Customer Service.
E25	Error/Fault	Call Customer Service.
E26	Error/Fault	Call Customer Service.
E27	Error/Fault	Call Customer Service.
E28	Error/Fault	Call Customer Service.
E29	Warning	Generator Fault, Overheating (allow to cool off)
E30	Error/Fault	Call Customer Service.
E51	Error/Fault	Call Customer Service.
E52	Error/Fault	Call Customer Service.
E53	Error/Fault	Call Customer Service.
E54	Error/Fault	Call Customer Service.
E55	Error/Fault	Call Customer Service.
E56	Error/Fault	Call Customer Service.
E57	Error/Fault	Call Customer Service.
E58	Error/Fault	Call Customer Service.
E59	Error/Fault	Call Customer Service.
E60	Error/Fault	Call Customer Service.
E61	Error/Fault	Call Customer Service.
E62	Error/Fault	Call Customer Service.
E63	Error/Fault	Call Customer Service.
E64	Warning	Call Customer Service.
E65	Error/Fault	Call Customer Service.

Table 4: List of Error Codes

E90	Error/Fault	Call Customer Service.
E91	Error/Fault	Call Customer Service.
E92	Error/Fault	Call Customer Service.
E151	Error/Fault	Call Customer Service.

Caution: Disconnect the **ZIEHM 7000** from the wall power source before performing any cleaning or disinfection.

Cleaning and Disinfecting

Cleaning

To ensure that the system is not damaged during cleaning, follow these rules:

- Only use common, non-abrasive cleaning liquids to clean exterior metal parts. Never use abrasive cleaners or solvents!
- Never spray the cleaning solution onto the equipment!
- To clean exterior metal parts of the equipment, use a soft towel that has been moistened with a common, non-abrasive cleaning liquid.
- To clean the monitors you need: 100% alcohol (or a mixture of 75% alcohol and 25% distilled water), and two (or more) soft, clean cloths. Moisten a cloth with alcohol and wipe the monitor glass surfaces clean. Immediately use a dry cloth to dry the monitors.

Disinfecting

We guarantee that equipment surfaces can be disinfected with any of the following solutions:

- 97% water and 3% Incidin
- 80% water and 20% Ultrasol F (5 parts water to 1 part Ultrasol F)
- 65% water and 35% Formaldehyde

Please observe the following:

- Never use pure alcohol or pure Sagrotan to disinfect equipment surfaces! These chemicals can permanently destroy equipment paint.
- Never spray disinfectants onto equipment surfaces! The spray might get inside the equipment and damage electronic components. Spray vapors inside the equipment can ignite.

Note: The film cassette holder can be sterilized.

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